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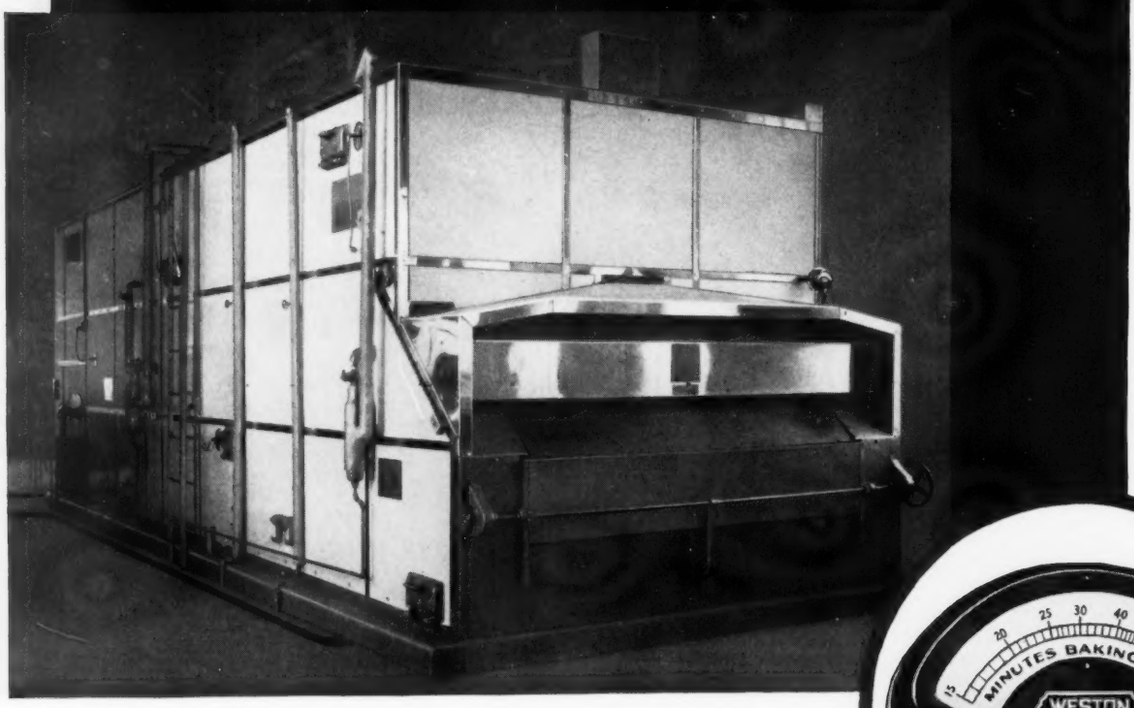

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●

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●

We are confident of the future. We have added to staff, to pages in the paper, to expenses. All done on faith, for we have no surplus earnings to throw away. Our advertising certainly did drop during the depression, but now we are going ahead, and so is the electrical industry.

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April 14, 1934

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ELECTRICAL WORLD

Established 1883—McGraw-Hill Publishing Company, Inc.

for the Week Ending

April 14, 1934

L. W. W. MORROW, *Editor*

PUT 1934 MONEY TO WORK

The second week of April, 1934. First quarter reports of business are flooding in with a strong preponderance of good news. Here are some national figures showing roughly the gains over the corresponding interval in 1933: Building construction up 194 per cent; steel mill operations 205 per cent; farmers' income 63 per cent; carloadings 30 per cent; automobile sales 185 per cent; electrical energy production 15 per cent, and department store sales 22 per cent. People have more money and are spending it.

It is estimated that the average family will have had its buying power increased in 1934 by something more than $500. A monthly purchasing power of $1,100,000,000 has been released by federal expenditures, payroll additions and increases, and higher profits and prices.

The automobile industry knows this is 1934. It planned early, produced early and sold early. It started business with confidence and sold with confidence. It affords a fine example to the electrical industry and to the nation.

The electrical industry will get a share of the 1934 dollars, but the amount of that share will depend on the selling effort expended and the confidence that inspires it. Higher income, greater energy output, increase in number of customers, and better appliance sales are already reflected in current statistics. In volume of energy output the utilities are back to the levels of their golden days. Some properties now face the necessity of early planning for the building of added facilities.

Manufacturers are getting more business. Consumer devices are showing definitely better volume and sales of industrial, utility and other heavier-duty products have increased by reason of augmented maintenance and replacement buying. It cannot be said too often that it is time for the electrical industry to regain a perspective.

Facts once again indicate the realities of the opportunities for growth and expansion in the generation, utilization and sale of energy as well as in equipment. Real planning and organized action will enable utilities and manufacturers to far exceed past business records in the coming months. This new buying power, call it inflation, call it forced recovery, call it what you will, is dynamite to break the depression jam. Business floodwaters will again flow for the electrical industry if it takes advantage of 1934 facts. They afford reason for confidence, for optimism and, above all, for aggressive action to get a share of the dollars that now jingle, at least figuratively, in the pockets of the buying public.

BUILT-IN LIGHTING WINS

Under the joint influence of art and technology the residual emblems of primitive lighting are fading. At least as far as churches are concerned it seems that the chandelier or any pendant form of lighting is doomed. Art students competing for the Illuminating Engineering Society's prize award have so decreed, only five out of 209 entries holding to the visibly suspended luminous source. Most of them swung positively toward the mysticism and quiet reverence of indirect sources fully concealed. So much direct illumination as was incorporated in the entries was in the nature of beams to give radiant prominence to the altar, pulpit or other spot entitled to discriminative treatment. Color—of light and of lighted surfaces—and form—slashes and arcs of light—were features of many of the projets.

Illuminating engineering is keeping abreast of the esthetic drift by providing the tech-

nical means of executing the artists' conceptions. The startling thing is that any style of architecture, whether it be Gothic, Greek, Italian or Mohammedan in motif, finds lighting technic at its command. Innovations in the theater, such as celestial ceilings and tone control, will undoubtedly be transferred to houses of worship as fast as they can be rendered dignified and meditatively inspirational.

BAD INDUSTRIAL BARGAINS

Acute interest in costs normally waved aside in good times is characteristic of industrial plants considering renewal of power contracts under present conditions. Formerly many manufacturers were glad to get rid of the specialized task of power production and distribution to load centers by buying it even at an unfavorable differential above their computed costs. Today close figuring is customary, and the proper valuation of all items entering into the power picture calls for a thoroughness of analysis and a critical survey of rates often unnecessary in the past.

Thus, a mill may go into the second-hand machinery market and buy a unit at an absurdly low price in order to seek a nominal overhead cost, a 2,000-kw. steam turbo-generator having been secured in a representative instance for $4 per kilowatt. The manufacturer is satisfied that he can produce electricity around 6 or 7 mills per kilowatt-hour, and this may be so, but if his bargain turns out to be a poor one through the failure of the unit on a day when the plant is straining every nerve to complete a rush order and the inability of a smaller reserve unit to carry the load, the picture will change. Fuel costs are rising too.

OIL COMPETITION LESS KEEN

Power salesmen who have been combating oil engine competition through the last few years are feeling better. While equipment costs were low oil engine companies capitalized the subnormal fuel prices to the utmost and by amortizing the purchase over a long period built up attractive propositions. Many factories, harassed by low volume, were lured into an adventure in power generation that they would never have hazarded but for the figures that hard times made possible.

Now operating costs are going up. Fuel oil that was 60 cents is now $1.20. Coal that was 85 cents at the mine is $1.65 a ton. Other supplies have risen likewise. The average is probably 50 per cent, and that makes a deal of difference in the cost of running a private plant.

The principles involved have not wavered. The dependability and economy of central-station service has continued to offer advantages where management soberly analyzed the facts. But in the pinch, apparent quick savings too often upset the economics of the case. Now costs and values are getting back into sound perspective and it is a good time to recanvass all power accounts.

TO WIN PUBLIC INTEREST

Looking back over the past few years in which the utility industry has been in the limelight of discussion, one fact stands out. There has been little public interest in the power company's side of the argument.

The reason why the politician's story is always appealing is because he talks not about himself but about the public interest. He has made his story personal. Those he assails do not. "This power company," he says, "for this reason and that has charged you too much for its service." And John and Mary say, "That's not fair!" Thus begins grievance and antagonism toward their utility company and the "power trust."

And then what does the power company do? Perhaps it says nothing or even begins to talk about itself—its rates and its record. In neither case does it accomplish anything. For the public is not interested in any power company. It is interested in itself. People will listen and approve only when the story clearly concerns them.

All this is a matter of psychology. It is not a matter that most engineers and financiers understand. It lies in the realm of advertising, to which few executives have ever given any serious thought. Yet when it comes to the point of danger, the executive naturally assumes control and does the talking. And John reads the statements by the power company and soon tires and turns the page. And Mary hears a leader of the industry making an address over the radio and quickly tunes him out. For rates, figures, legal rights and economic principles mean nothing in their intimate lives.

Utilities could well recognize this, talk of the consumer, and what its service does for him. It is a time-proven approach in other fields.

How We Raise Hydro Efficiencies

By E. B. STROWGER

Assistant Hydraulic Engineer Buffalo, Niagara & Eastern Power Corporation

By a venture in human engineering, correlating the collection and use of current operating data with the desire of the plant operator to produce improved results, higher efficiencies are obtainable.

Operating staff morale raised while increasing interest and responsibility in keeping daily records in detail.

SUBSTANTIAL increase in the operating efficiency of the hydro stations of the Niagara Hudson System has been effected by furnishing the station operators and the load dispatchers with information in the form of curves and tables showing the best operating procedure for any condition of river stage and for any station load. Besides improvements in utilization of existing resources, an important consideration is the increased morale given the operator by virtue of a somewhat wider scope of duties and responsibilities. It is felt that by changing the operator's job from one of a more or less perfunctory nature to one involving the keeping and the analyzing of the records of his operations his interest has been greatly increased. Furthermore, the keeping of a hydraulic log as well as of an electrical log has resulted in discovering and correcting faults in operating which otherwise might not have been discovered for some little time.

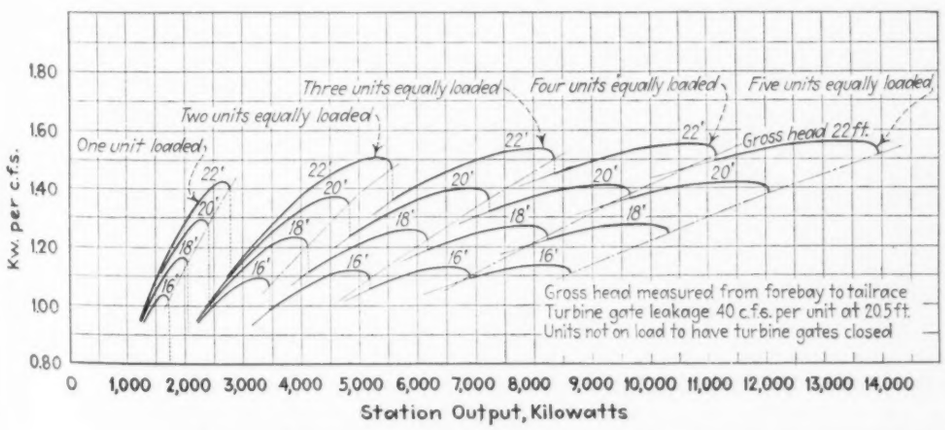
The Niagara Hudson System is in effect the integration of a number of electric utility properties comprising both steam-electric and hydro-electric generating stations. The individual systems of the operating companies are interconnected by the lines of relatively large capacity which enable advantage to be taken of any diversity of load characteristic and of available energy supply in the operation of the system as a whole. To operate to the best over-all advantage requires a co-ordination of the activities of the individual station operators. This is accomplished by having divisional load supervisors working through local load dispatchers to the individual station operator.

The hydro-electric stations are well diversified as to location and as to character. The north slope of the Adirondack Mountains where the rivers flow into the St. Lawrence, the south and east slopes where the Hudson and Mohawk Rivers form the main drainage system and the areas in New York State bordering on the east and south shores of Lake Ontario give the stations this diversity, both as to location and as to character of drainage area. Also it will be readily recognized that the characteristics of the plants themselves would be widely divergent, depending upon the character of the resource and upon the design adopted for a particular project.

Tests made on all but 4 per cent of capacity

The problems of co-ordinating the operation of the various hydro stations for a maximum over-all efficiency led to subjecting all properties to tests, the detail and refinement of which for a given station was commensurate with its importance.

In general, the Gibson method of testing has been used in this work on all installations where a closed column of water at least 20 ft. long was available. If such a column were not available tests were made by other practicable methods. If a station had an installation of



Family of curves for a series of head values for station B is typical of a project having individual penstocks for the units as is usually found where a power house is built integral with the dam. With this type of station the operating efficiency is progressively greater as units are added to those operating, on account of eliminating the leakage loss taking place in the standby units. From this curve it is apparent that with a gross head of 22 ft. and with one unit loaded a maximum of 1.42 kw. is obtained per c.f.s., but with five units operating under this head a maximum of 1.56 kw. is obtained per c.f.s. It is evident that with 22 ft. of head available the greatest economy occurs when the station is operated with five units on load with a load of 13,500 kw.

Fig. 1—Envelope efficiency curves show how to operate station B for best results

such relatively small capacity as not to justify the expense of a test, then the characteristic operating curves were estimated, using as a basis the manufacturer's guaranteed or expected curves and a simple power gate test made at the station for determining capacity. In case a station had already been tested by an accepted method, such as seven stations which had originally been tested by the Allen method, a repeat test was not considered necessary in preparing the initial schedules. Of a total of 94 stations, field tests were completed on 58. The stations tested, however, represent about 96 per cent of the system hydro-electric capacity. It is obvious from these figures that only the stations of relatively small capacity were not included in the testing program.

The program covered a period of about two years, during which time two parties carried on the field work. Each party was headed by an experienced testing engineer who had an assistant from the main engineering office. The rest of the party was made up of men from the local divisional office who assisted in the work.

Measurements taken for a rating test usually included all those necessary to segregate the losses between the various component parts of the project such as the water conduit above the forebay, the penstock, the waterwheel, the tailrace and the generator. To accomplish this, readings were taken of water quantity, electrical output, gross and net head and turbine gate opening. Electrical measurements were taken by men from the nearest electric meter department and consisted of kilowatt output, current, voltage and power factor of the main generator and power, current and voltage of the exciter. All meter and instrument transformers were specially calibrated for each test.

Three rules for load division and load dispatching

The fundamentals of economic load dispatching between units of a hydro station have been covered fully in numerous publications of rather recent date.* These principles may be summed up in three rules as follows:

1. The number of units to be selected for carrying the load should be such that greatest economy in the use of water is obtained for a given load.

2. Station load should be so divided between units operating as to obtain equal values of incremental efficiency, or, in other words, equal values of the first derivatives of the power discharge curves. In the case of units of identical characteristics the load should always be divided equally between the units operating.

3. If possible, that station load should be carried which corresponds to the highest efficiency point of the station.

Of course, these rules must be qualified by such considerations as the maintenance of sufficient system reserve immediately available, voltage conditions, stream flow conditions or by any special local limitations which may exist. They serve as the ideal to which the operator strives to attain.

*See "Inter-relation of Operation and Design of Hydraulic Turbines," by Rogers and Moody, presented at Third American hydro-electric conference, Engineering Club of Philadelphia, May 10, 1925. "Operating a Hydro-Electric System for Best Economy and Means Employed for Checking Performance of Operation," by E. B. Strowger, N.E.L.A. Bulletin, December 19, 1929. "Automatic Operator for Economy Control," by S. Logan Kerr, presented at the Middle Eastern District Meeting No. 2 of the A.I.E.E., Philadelphia, Pa., October 13-15, 1930.

Table I—Station A, Preferred Loading Schedule

Standby Leakage of 15 c.f.s. per Idle Unit
Gross Head = 284 Ft.
Three Units Equally Loaded, One Unit with Turbine Gates Closed

Station Kw.	Station c.f.s.	Station Kw.	Station c.f.s.
19,000	1,018	19,400	1,040
19,100	1,023	19,500	1,045
19,200	1,029	19,600	1,051
*19,300	1,034*	19,700	1,056

*Point of maximum efficiency.

Charts translate ideals into practical operating guides

TO TRANSLATE these principles into practical operating schedules use was made of charts and preferred loading tables. Figs. 1 and 2 show sample envelope efficiency curves which give the locus of the points of highest efficiency in moving through the whole range of station loads. These curves form a means for carrying out rule No. 1. Values of kilowatts per c.f.s. are used for the ordinates of the curves instead of values of efficiency because they are of greater significance. In making these curves the total water quantity used by the station is to be considered. If leakage takes place through standby units this water should be taken into account in determining the values of kilowatt per c.f.s. Table I gives a preferred loading schedule, the figures of which are taken from an envelope efficiency curve. The latter gives a visual representation of the relative economy of operation of the station at various points on the load curve and is a valuable tool to the load supervisor. The station operator, however, usually prefers the use of a table to that of a curve sheet and consequently the preferred loading schedule has in almost all cases been furnished the station operators.

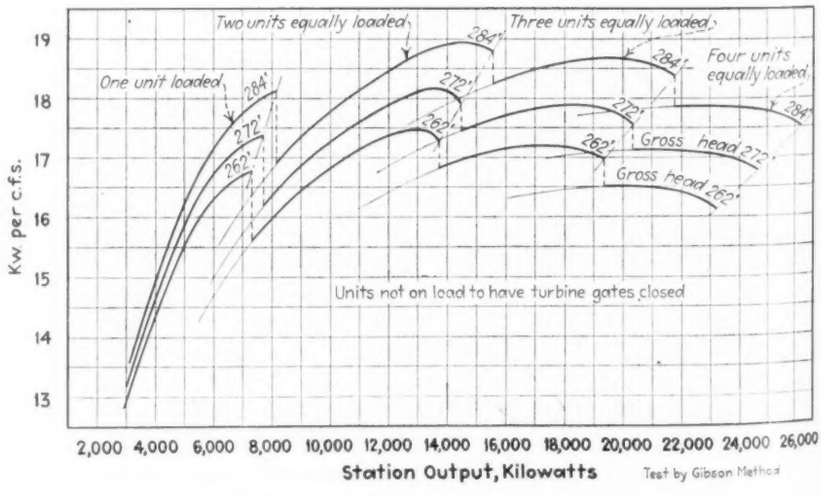


Fig. 2—Long pipe line of station A results in different envelope efficiency curve

In this case as the station load increases more units are added, thus eliminating the leakage loss taking place in the standby units, but since the conduit loss varies as the square of the velocity a point is soon reached where the increased conduit loss is more than enough to offset the gain due to the decrease in standby losses. Consequently the envelope of the curves turns over and when the gross head is 272 ft. the best point of operation appears to be when two units are operated at a load of about 13,600 kw.

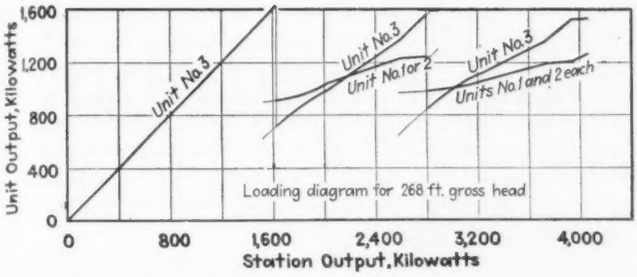


Fig. 3—Loading diagram as well as envelope efficiency curve needed if units have dissimilar characteristics

Values of station c.f.s. for any station load are given on the schedule for the convenience of the operator in keeping his records. The points of maximum efficiency for the various combinations of units operating are specially marked as a means for carrying out rule No. 3.

In case a station contains several units with unlike characteristics a "loading diagram" must supplement the envelope efficiency curve in order to give a load allocation between the units operating and thus furnish a means of carrying out rule No. 2. A sample of such a loading diagram is given in Fig. 3.

Hydraulic log sheet checks operations

In order to furnish a ready means of checking and analyzing the operation of a station a "hydraulic log sheet" was designed to supplement the existing electrical log sheet. This log sheet is shown by Fig. 4. Besides providing a means of checking operations the hydraulic log furnishes basic records of steam flow and useful hydraulic data and its use has proved beneficial to the operator both by giving him more or less complete information on the station he operates and by giving him the opportunity to keep pertinent records from day to day which he may examine. Although it is designed for general application, to date its application has been limited to the so-called key stations on the system, one or two of which are located on each main river.

An individual manual of instructions for applying the log to each station has been made up. This manual contains a complete explanation of all terms used and gives sample computations where they are considered necessary. It gives tabulations of station capacities, turbine gate leakage values, constants, spillway discharges, log, trash and ice chute discharges, preferred loading schedules, etc., which have been based upon tests and engineering studies.

Fig. 5, which shows a plan of development D, gives the relation between pond, forebay and tailrace elevation as defined for use with the log. In general, pond elevation refers to the river level at the point of diversion and forebay elevation refers to the water surface elevation at or near the intake works or headgates. Whenever possible elevations refer to U.S.G.S. datum.

Hydraulic losses also tabulated

ITEM marked "unit c.f.s." on Fig. 4 is readily determined by a single table in the case of an installation where individual conduits serve the various units. In the case of a pipe line supplying several units, however, two tables are necessary in order accurately to arrive at the unit c.f.s. The first tabulation, a sample of which is shown in Table II, gives the loss in the conduit as a function of the kilowatt load on the station. The assumption that a definite loss in head exists for a given kilowatt load may introduce an error which, however, is only of the secondary order of magnitude, as we are dealing with a differential of the *loss* in head and not a differential of the *total* head. The second tabulation, as shown in Table III, then converts the unit load into unit c.f.s. as a function of net head (called "head at distributor" or "head at surge tank," etc.).

The use of water for ice and trash sluicing is taken into account in order that the power value of this water may be determined and to enable a station, where large amounts of sluicing is necessary, to present a fair record of performance.

Tables IV and V show typical rating figures for a spillway and for a Taintor gate section.

The "load division loss" shown on the log sheet is concerned with economic load distribution between units and the economic combination of units in service. The load assignment loss represents the loss incurred due to the operation at points removed from the maximum efficiency point. If the units are operated with the proper

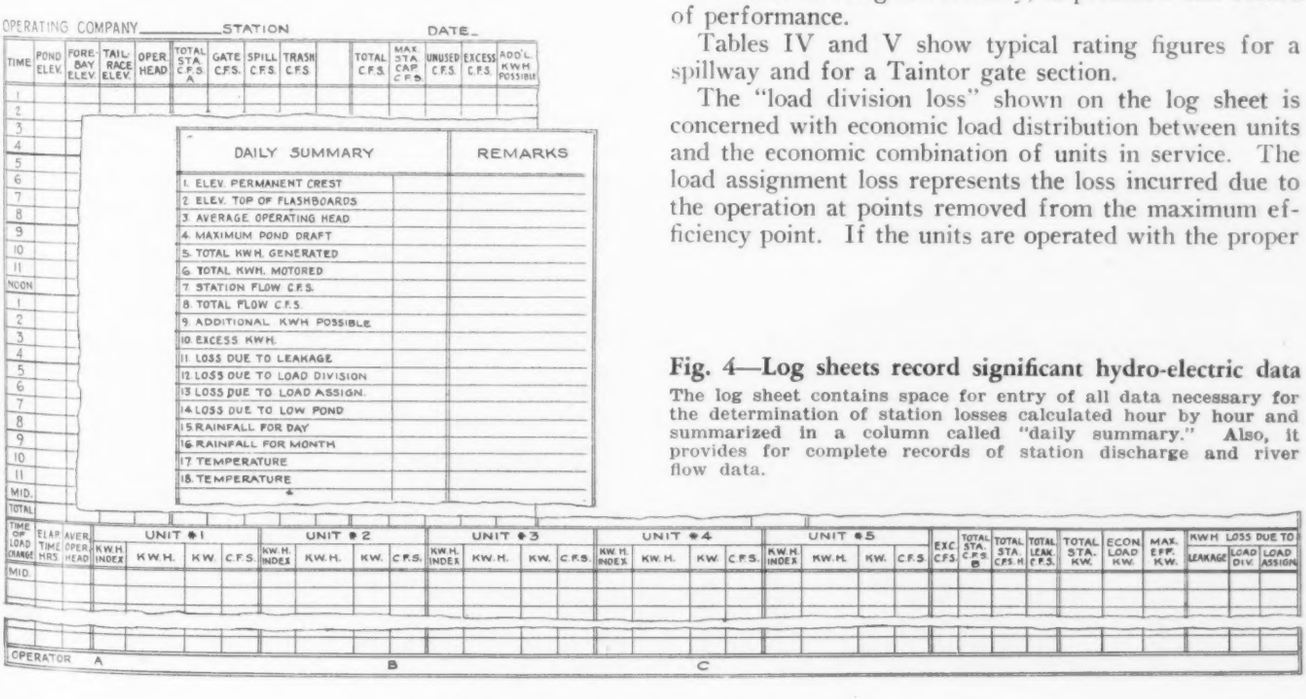


Fig. 4—Log sheets record significant hydro-electric data

The log sheet contains space for entry of all data necessary for the determination of station losses calculated hour by hour and summarized in a column called "daily summary." Also, it provides for complete records of station discharge and river flow data.

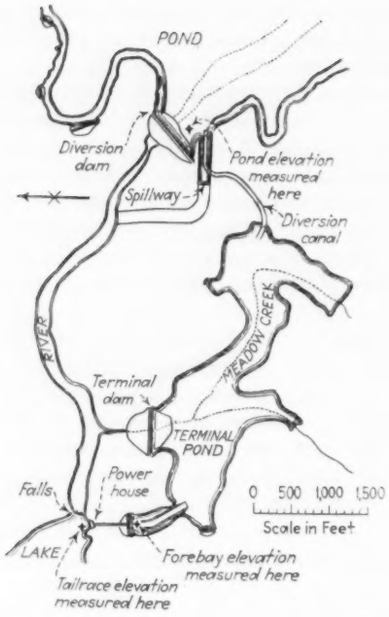


Fig. 5—Map shows specifically where log readings are to be taken

Table II—Station A, Loss of Head—Reservoir to Distributor in Feet

Station Output, Kw.	Operating Head in Feet						
	257	262	267	272	277	282	284
19,000	24.6	23.7	22.8	22.1	21.6	21.0	20.7
19,100	25.0	24.0	23.0	22.3	21.8	21.1	21.0
19,200	25.2	24.2	23.2	22.5	22.0	21.3	21.1
19,300	25.5	24.5	23.5	22.6	22.1	21.5	21.3
19,400	25.7	24.7	23.7	22.8	22.3	21.6	21.5
19,500	26.0	25.0	24.0	23.0	22.5	21.8	21.6
19,600	26.2	25.2	24.2	23.2	22.6	22.0	21.8
19,700	26.5	25.5	24.4	23.3	22.8	22.2	22.0

Table III—Station A, Unit Discharge in C.F.S. for Various Unit Loads

Unit Load, Kw.	Net Head at Distributor in Feet							
	272	274	276	278	280	282	284	286
6,200	323	321	320	318	317	315	313	311
6,300	327	326	324	323	321	320	318	316
6,400	332	331	329	327	325	324	322	320
6,500	336	334	333	331	329	328	326	324
6,600	340	338	337	335	333	332	330	328
6,700	345	343	341	339	337	336	334	332
6,800	350	348	346	344	342	340	338	336
6,900	354	352	350	348	346	344	342	340
7,000	359	357	355	353	351	349	347	345

Table IV—Station A, Spillway C.F.S.

Flashboards In		Flashboards Out	
Reservoir Discharge		Reservoir Discharge	
Elev.	c.f.s.	Elev.	c.f.s.
937.0	0	935.0	0
0.1	30	0.1	30
0.2	70	0.2	72
0.3	130	0.3	126
0.4	210	0.4	196
0.5	280	0.5	278

Table V—Station A, Taintor Gate C.F.S.

Discharge Tables for Water Flowing Through One Taintor Gate

Reservoir Elev.	Taintor Gate Opening Above Sill					
	1 ft. 0 in.	1 ft. 3 in.	1 ft. 6 in.	1 ft. 9 in.	2 ft. 0 in.	2 ft. 6 in.
936.0	266	331	395	457	518	633
0.1	269	333	398	460	521	639
0.2	270	336	400	463	525	643
0.3	271	338	403	466	529	649
0.4	273	340	405	469	533	653
0.5	275	342	408	473	536	658

load division and also operated at the point of maximum efficiency, as shown by the envelope efficiency curve, then both of these losses would be zero. If the units are operated with the proper load division at some point on the envelope curve, but not at the maximum point, then the load division loss is of course zero and the load assignment loss is the difference between "kilowatt-hours at maximum efficiency" and what is called the "economic load kilowatt-hours."

In the daily summary there appear two items labeled "maximum pond draft" and "kilowatt-hour loss due to low pond." Maximum pond draft, of course, is the difference between the highest and the lowest pond elevation for the day. The "kilowatt-hour loss due to low pond" is based upon the kilowatt-hour loss over the day due to the fact that the pond level is not brought to the maximum at any time during the 24-hour period. Such a calculation is of value at a station where no weak end or seasonal pondage can be used to advantage. At some stations, of course, it is desirable to omit this item entirely.

Scheme holds losses to low values

Although in parts of the system the use of economical operating schedules is not new, the extension of their use would naturally be expected to result in obtaining somewhat higher operating efficiencies for the system as a whole. This expectation has been confirmed by the analysis of recent operating records of several stations which show that operating efficiencies greater than 95 per cent have been attained. One example of such a record is given for station E for the months of July and August, 1932, as follows:

	July	August
Kilowatt-hours generated	3,938,000	4,867,000
Kilowatt-hours possible	4,003,900	4,906,900
Operation (load division)	0	0
Losses in kilowatt-hours (load assignment)	58,500	39,900
Loss due to low pond	37,100	67,900
Loss due to unused water	7,400	0
Loss due to excess water	0	0
Loss due to leakage	0	0
Operating efficiency	98.3	99.2

The term "operating efficiency," as used herein, may be defined as the ratio of the actual generation to the possible generation expressed as a percentage. The difference between the actual and the possible generation is made up of the recoverable operating losses, including that due to load division, the loss due to load assignment and that due to unused water (within the plant capacity). The loss due to standby leakage has not been considered a recoverable loss except where the leakage quantity is of such an abnormal value as to justify repairs. The loss due to low pond has also been excluded since it is considered reasonable to charge this against system operation. The loss due to excess water, of course, is not a recoverable loss inasmuch as it is caused by water spilled over the dam in excess of the plant capacity.

It should not be understood that the gains effected in operating efficiency are due to any previous laxity on the part of the individual operator in doing his job. In general, within the limits of his knowledge, he has done commendable work. However, the information made available to him in the form of accurate and definite operating schedules, based upon test results, has enabled him to approach closer to the ideal.

Lighting Can Be Trouble-Free

By ARTHUR A. BRAINERD

Director Lighting Service Division, Philadelphia Electric Company

If the industrial user's viewpoint of satisfactory service be accepted as a standard, maintenance factors dominate the lighting problem.

Tackle the working area, says Mr. Brainerd, and then see to it that time and neglect will not ruin the job.

NEW lighting installations nearly always look fine. Clean reflectors, new lamps and, many times, new machines and new paint all help to make even a mediocre lighting system look efficient on the day the current is first turned on. The management looks it over and approves. The electrical engineer is congratulated, but there is trouble in the offing! Look over the same job on the first anniversary of its birth. Too often we find dirty reflectors, finger-printed lamps, frayed drop cords and discontented workers. Go back again on the second, third and fourth birthdays. The result is many times a tragedy.

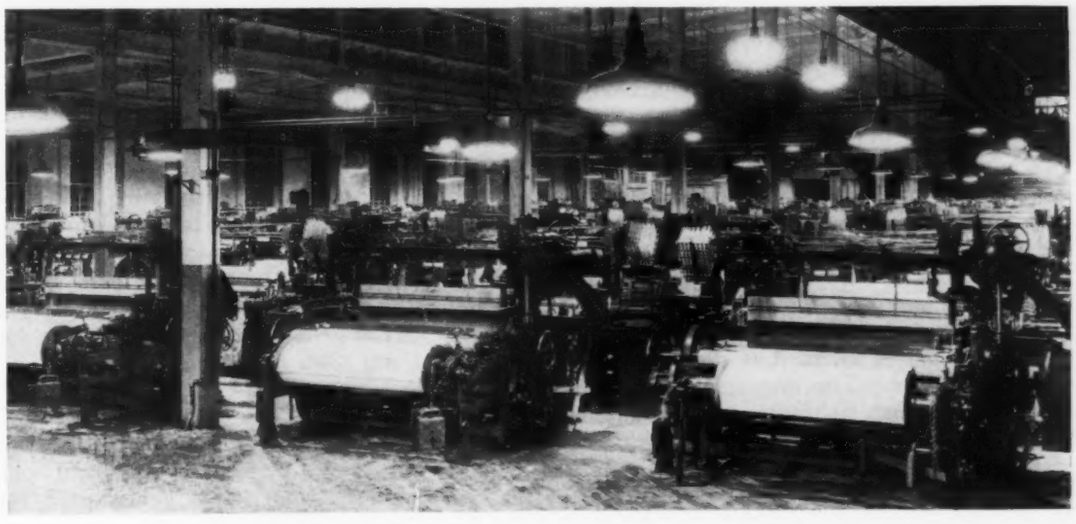
This is a story of a factory that planned a lighting system not only to look efficient, but to be efficient on its fifth birthday. The Aberfoyle Manufacturing Company of Chester, Pa., planned to equip a weave shed with 250 looms. The new machines were to be the best that money could buy, the interior was to be refinished with good light-reflecting paint and the lighting system must be of the highest quality. Every type of industrial lighting equipment available was tested under normal working conditions, to determine which would give the best lighting five years from the date of installation.

When the equipment to be used had been decided upon, one stand of looms was taken as a test and equipped with several lighting units which could be readily adjusted in any desired position. Experienced weavers were then brought in to assist in determining the proper direction of light for the best results, by experiment. With this help a thorough exploration was made of the light distribution in working spaces, down in the harness and in the other critical parts of the machine. Equipped with this information, a complete lighting and wiring layout was made which would insure excellent lighting and initial and maintained efficiency, with reasonable cost of installation, and low cost and ease of maintenance.

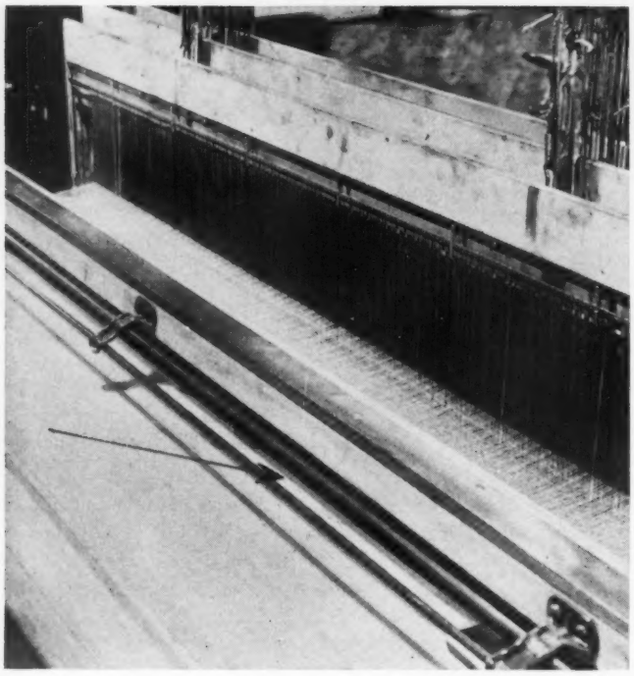
The final lighting layout is simple. The standard unit is a 300-500-watt size R.L.M. reflector with a built-in socket for conduit mounting and equipped with a disconnecting attachment. The whole unit is suspended by means of a ½-in. conduit from a condulet which allows a swing of 20 deg. in any direction. Inside frosted lamps are used throughout.

The wiring system adequately provides for future load and for proper voltage at the lamp socket. In general, there are seven mogul socket outlets to each branch circuit. Number 6 wire is used with No. 10 tap-offs to the socket.

The results secured from the final lighting system have more than justified the time and effort put forward in its planning. The critical work spaces are provided with an adequate intensity of well-diffused illumination,



Flexible stem suspension, disconnect sockets, units mounted well above ordinary reach and adequate wire capacity insure low cost and efficient maintenance



Close-up of reed-head under uniform general illumination to prevent shadows

ranging from 6 foot-candles down in the harness to 26 at the breast beam. Troublesome shadows have been eliminated. Weavers find that it is much easier to locate broken ends and discover other weaving defects. The illumination is secured from the minimum number of high efficiency units, an average of less than one outlet per machine. There are no drop cord suspensions. Reflectors are mounted high enough from the floor to eliminate the danger of fingerprints on reflecting surface or lamp. A disconnecting hanger makes it a simple matter to remove a dirty reflector and replace it with a clean one.

Wiring and reflecting equipment is adequate to increase the lighting intensity 80 per cent by a simple change of lamps. Automatic circuit breaker type panels eliminate the nuisance of stocking and replacing fuses. And last, but not least, the whole room presents an unusually clean, workmanlike appearance.

The best criterion of any lighting job is performance. Frank Olden, the electrical engineer, was so thoroughly convinced of the effectiveness of the system that within two months he started altering another weave room to conform with this plan.

This method of attacking an industrial lighting problem gives the men who have to live with the job, and not the the lighting engineer, the decision on the quality of the results. Particular attention is paid to getting the best possible effect in the actual working space, rather than attempting to light aisles and working areas alike. To do this with a system that will bring the minimum of maintenance grief to the electrical engineer effectively gives trouble-free lighting.

100 Kw. from Russian Winds

By W. R. SECTOROV

Engineer Wind-Power Institute, Moscow, U.S.S.R.

Refreshingly unconventional and larger than any others to have been extensively used, this 100-kw. Soviet experimental plant is said to have satisfactorily withstood, and operated under, a year of climatic changes.

IN NEED of great quantities of electric energy for its industrial program, the Soviet Union is interested in the full utilization of all sources of energy available. In addition to the erection of fuel and hydro-electric plants, an experimental unit for wind-electric generation has been tested with the idea of building if possible 5,000 kw., and larger, wind-power plants as a source of base load power supplemented by hydro plants. The Balaklawa region of the Crimea, in which this experimental unit was tested, has winds suitable for such utilization. These units would be tied into the high-voltage networks.

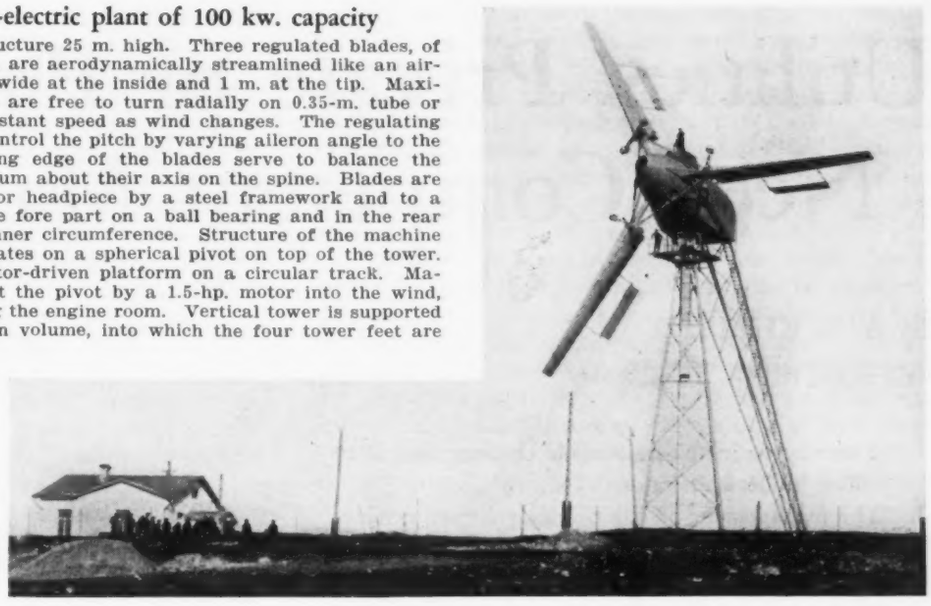
The experimental unit consists of a high-speed wind motor rated at 180 hp. and an asynchronous 100-kw. generator. The generator unit and automatic switching are mounted in the machine room, placed on the 25-m. high structure as shown in the accompanying illustration. Electrical energy at 220 volts, three phase is transmitted from the generator by a sliding connection and cables to the power house, where it is stepped up to the 6.3-kv. network voltage. The unit supplies energy in parallel with a steam-turbine plant of much larger capacity to feed the regional network.

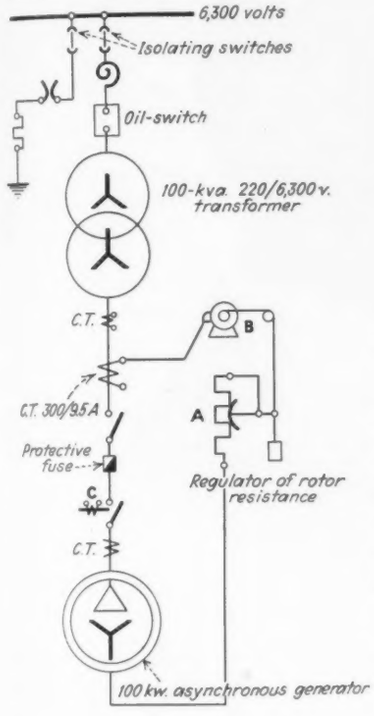
The windwheel, 30 m. in diameter, has self-regulating variable-pitch blades mechanically regulated by the centrifugal force produced by a change in wind and speed, so that the speed tends to remain constant. The mechanism of this control consists of weights inside the blades resisted by springs, and any change in speed of rotation is transmitted by a system of links and levers to change the position of the ailerons, which in turn causes the effective pitch of the blades to change and thus tend to keep the speed and voltage constant. This whole mechanism is in the rotating nose of the unit. Starting and stopping of the wind motor proceeds in the same manner by turning these stabilizing ailerons. The total weight of the structure and unit is 50 tons; the heaviest part, the rotating nose, weighs 8 tons without the blades. The generator is driven by gears meshing with the rotating nose.

The shaft of the windwheel and generator is inclined at 12 deg. to the horizontal plane, so the generator is provided with a pivot bearing in addition to regular bearing to carry the horizontal component of the weight of the rotor. The generator is rated at 220 volts, 600

Balaklawa experimental wind-electric plant of 100 kw. capacity

The windwheel is 30 m. in diameter; structure 25 m. high. Three regulated blades, of wood and metal covered with sheet steel, are aerodynamically streamlined like an airplane wing, each blade 11 m. long, 2 m. wide at the inside and 1 m. at the tip. Maximum blade thickness is 0.68 m. Blades are free to turn radially on 0.35-m. tube or spine to vary pitch of the blades for constant speed as wind changes. The regulating weights inside the blades centrifugally control the pitch by varying aileron angle to the wind. Dumb-bell weights on the leading edge of the blades serve to balance the ailerons and make the blades in equilibrium about their axis on the spine. Blades are tied together and to the rotating nose or headpiece by a steel framework and to a large cast steel rim. Nose rotates in the fore part on a ball bearing and in the rear the rim runs on rollers supporting the inner circumference. Structure of the machine room is a steel frame and the whole rotates on a spherical pivot on top of the tower. Tailpiece and ladder terminate on a motor-driven platform on a circular track. Machine room and windwheel rotated about the pivot by a 1.5-hp. motor into the wind, actuated by a direction-vane surmounting the engine room. Vertical tower is supported on four blocks of stone work 15 cu.m. in volume, into which the four tower feet are sunk to a depth of three meters.





Circuit of windwheel plant and connection to network

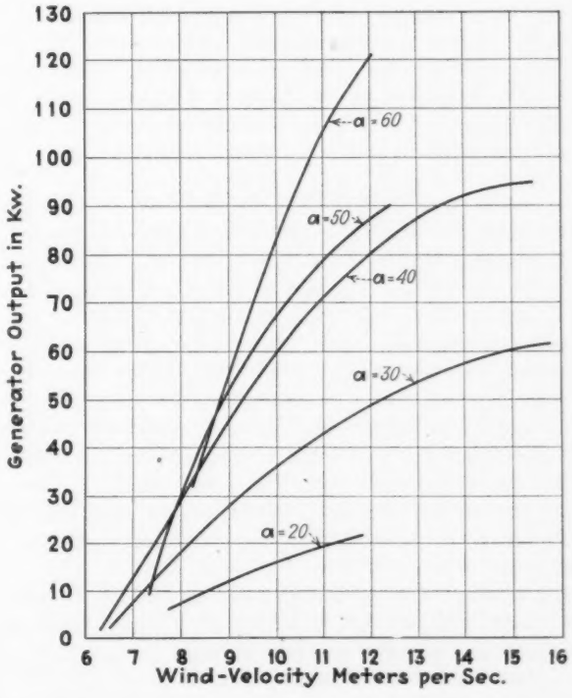
The sliding regulator of rotor resistance, *A*, prevents overloading of the generator by introducing additional resistance into the rotor circuit with the assistance of the motor, *B*, working from current transformer in main generator circuit. *C* is a solenoid-control circuit breaker which cuts in the generator when wheel is up to speed.

syn. r.p.m., power factor 84 per cent; low voltage was adopted for the protection of the experimenters. The rotor is phase-wound and, to prevent the generator from being overloaded, has a motor-controlled rheostat slip-regulator in its circuit, which is actuated by a current transformer in the output circuit. This control and arrangement of all control and electric equipment are shown in the diagram.

When the unit arrives at synchronous speed the generator is automatically cut in, and after the wind dies down the generator is automatically cut out until the wind rises again. All automatic equipment and relays are operated on alternating current, 220 volts, thus eliminating the cost of d.c. equipment and battery; this auxiliary power is supplied by a house transformer. Phase synchronization is not necessary before the unit is cut in, but only a speed roughly that of synchronism is needed, so a centrifugal mechanism is used to open or close the circuit of a solenoid-operated circuit breaker connecting the generator to the output low-voltage side of the transformer.

Generator relay protection consists of two wattmetrical relays and one overcurrent relay. In addition, an auxiliary induction time relay serves after cutting in to block the circuit of the contact of the centrifugal mechanism.

Tests for twenty-minute average output with various wind speeds and various regulation sets were conducted by measuring the average wind velocity with an anemometer located on a 25-m. high mast 50 m. away from the unit. Total yearly output of the unit is 200,000 kw.-hr. Successful tests of the plant in continuous operation have been made for more than a year and show that these plants are available for parallel work with other electric power stations in regions where wind conditions are favorable.



Experimental output curves of windwheel plant

Curves show average capacity of the unit for twenty minutes at different average wind speeds with various blade regulations of the ailerons' initial angle *a* to the blade. This regulation must vary at different wind speeds to obtain maximum output from *a*-40 to *a*-60. The designed output of 100 kw. is obtained at the wind speed of 10.5 m. per second.

Utilities, Private or Public, Need Competent Management

By A. G. CHRISTIE

Professor of Mechanical Engineering
Johns Hopkins University, Baltimore, Md.

"The way to increase domestic consumption is to offer inducement rates.

"The management of our privately owned utilities has been energetic, aggressive and progressive.

"The financial policies of both privately and publicly owned utilities have been open to criticism.

"It may prove that the government's yardstick of rates is neither unreasonable nor so confiscatory as it first appeared."

MANY cities are undertaking the construction and operation of municipal electrical systems. These activities have caused considerable discussion, much of which has a political bias. Certain important aspects of the problem have received little or no attention, yet these elements may in the end be the factors which determine the success or failure of the enterprise. Among other things, rates, management, financial policies and plant are of outstanding importance. Experience has indicated that certain elements of these factors must be considered in the manner outlined in the following paragraphs, if a reasonable measure of success is to be achieved in publicly owned undertakings.

Rates depend upon use

The rates for domestic service recently announced by the Tennessee Valley Authority are very similar to those in effect in certain Canadian cities. Compared with the Canadian rates, the charges of American utilities to domestic consumers seem high, while those to power consumers are low. The justification of the two systems of charges, i.e., the Canadian and the American, has been debated at length without any effect on the practices of either party. This controversy does not need further prolongation. On the other hand, in view of the American government's yardstick for electrical rates, let us see what justification may exist for low domestic charges.

The average domestic consumer in the United States uses about 600 kw.-hr., for which the utility is paid, say, 6 cents per kilowatt-hour, a total of $36 per year. The greater portion of this charge, let us say $30 per year, is for such items as cost of metering, billing and collecting, for fixed charges on distribution system and meters, for the administrative expense, sales promotion, maintenance, etc., and for taxes, which have become a significant item in rates. Many of the above costs would not increase if the consumption were multiplied by two or three. The remainder of the cost, $6 per year, would represent a generation cost of 1 cent per kilowatt-hour. Suppose that consumption becomes 1,800 kw.-hr. per year, for which a total of $49 were charged. This amount would allow 1 cent per kilowatt-hour as before for the cost of current and still pay $31 of other charges. The average cost per kilowatt-hour becomes 2.72 cents under such conditions. Thus a substantial reduction in rate per kilowatt-hour would result from increased domestic consumption. The consumption of 1,800 kw.-hr. per year is not unreasonable, for even higher average consumptions are said to be obtained on certain of the Canadian systems.

Clearly, then, the difference in rates is not entirely due to differences in the form of ownership, but to the uses made of the electrical service in the home. Samuel Ferguson, president of the Hartford Electric Light Company, in the ELECTRICAL WORLD, December 2, 1933, discussed this point. In reply to a question as to why Canadians charge 2 cents per kilowatt-hour, while the average American price is 6 cents per kilowatt-hour, Mr. Ferguson said:

> The true explanation lies in the difference in average use and the effect of usage in reducing distribution cost. In the United States the average use is about 600 kw.-hr. per year; in Canada over 2,000. This reduces all fixed costs by more than two-thirds, if figured on a kilowatt-hour basis. . . . The cost (of electricity in the United States) is high because of small use—small use because of high price. It will not satisfy the American public to excuse and explain the high price, no matter how valid the reason. Some way must be found to break the vicious circle.

The way to increase domestic consumption is to offer inducement rates. American utility executives appear loath to try such rates as those now proposed by the government for the Tennessee Valley, on the basis that the American public is slow to install new equipment in homes which would lead to increased domestic consumption. Yet it has been the experience of many utilities that substantial rate reductions are followed by rapid increases in electrical consumption. An aggressive campaign to promote the use of domestic appliances, accompanying a reduction of rates, would help build up the increased demand. For instance, many would use electric ranges if service were offered at T.V.A. rates.

Another factor should receive consideration in connection with domestic rates. Since the start of the depression in 1929 it has been the general experience of American utility systems that the domestic loads have been well maintained and have on the average steadily increased since 1929. On the other hand, consumption by power users decreased very greatly. The revenue from domestic consumers, therefore, formed the backlog of the utility's business throughout the depression. In other words, domestic consumption is more stable and depression-proof than service to power users. This thought suggests that greater consideration should be given in the future to the further development of the consumption of individual domestic customers and decreased attention to the less dependable power business, much of which has, in the past, been taken on a marginal basis. The domestic customer should have the inducement rate rather than the power user. This reversal of policy will not be palatable to many utility executives. Yet the hope for additional profitable load in the future lies in the extension of domestic services.

With these thoughts in mind, it would appear that our privately owned utilities should give consideration to low inducement rates for domestic consumers and should take on less power business on too narrow a profit margin. In the end, it may prove that the government's yardstick of rates is neither so unreasonable nor so confiscatory as it first appeared.

Professional management essential

MANAGEMENT of privately owned utilities has been energetic, aggressive, progressive. No single factor has done more to improve the reliability and efficiency of our electrical systems than the technical committees of the late National Electric Light Association. The executive officials of privately owned utilities treat their positions as life jobs. They can plan carefully their systems for years ahead in the reasonable expectation that they will carry out these plans. This leads to judicious planning and economic execution of the work.

The curse of municipally owned electrical utilities in the United States has been the application of the spoils system of party politics to their administration. Permanency of employment is seldom assured to those in charge of planning and operation. This discourages the best engineers and executives from seeking employment in such services. Frequently poorly trained, inexperienced or even incompetent men who have political influence are given appointments. Also, each new official seeks to promote his own idea of development rather than to continue the policies of his predecessor. There results a lack of continuity and waste in the operation of many municipally owned systems.

The Canadians have in general been able to keep their municipally owned systems free from the spoils system. Their executives and even the minor employees regard their positions as permanent. Plans are made for extensions well into the future with a reasonable expectation that these will be carried out. Their employees take pride in their accomplishments and feel a personal responsibility for the success of their system. Such an attitude promotes efficiency and reliability.

If the new ventures in municipal ownership that are being undertaken in this country are to be successful, these services should be placed under a rigid civil service administration. Sufficiently high salaries should be paid to induce competent engineers to seek positions in the municipal plants. If this permanency of office is not fully assured, then one may expect trouble and incompetency to prevail, and ultimately the publicly owned systems must fail to produce the desired economic results.

Financial policies can be improved

THE financial policies of both private and public utilities have in the past been open to criticism. The basis of regulation of the various rate commissions, namely a certain return upon investment in property, has made it expedient for each privately owned utility to carry equipment on its books as long as possible, rather than to depreciate this plant at regular yearly intervals over its useful life. Many utilities are today burdened with undepreciated property that should have been written off the books years ago. The same policy of commissions encourages overinvestment in privately owned plants and distribution systems in order to establish a higher basis for rates. There is evidently something wrong with rate making on the basis of investment in property.

In the case of municipally owned utilities the financial problems are more involved. In the first place such an electrical system is generally financed through an issue of bonds which must be paid off or refunded at a certain date. A frequent mistake is made in the issue of such bonds for a term greatly in excess of the useful life of the electrical property covered by these securities. Replacement of the worn-out property at the end of its life requires the issue of additional bonds before the first bonds are retired. It will be evident that the rates to customers of the original plant were too low due to low amortization allowance on the original bond issue, while the users of the replaced equipment are excessively charged to cover the unpaid sinking fund charges remaining on the first bonds as well as charges on the second issue. It should therefore be an established principle that the term of a utility bond should be only the expected useful life of the equipment that it covers. This is a consideration of the greatest importance in the equitable financing of municipal plants.

Bonds may be retired by setting aside yearly amounts from earnings under the name of depreciation charges, amortization allowances, or sinking funds which are allowed to accumulate until the date that the bonds are due. In the case of municipalities, the handling of these funds presents serious problems, particularly when the amounts are large. The wise investment of such funds so that the accumulations are available when the bonds fall due calls for a high degree of financial skill, which unfortunately is not always found in the average finance

committee or utility commission of a municipal government. It has been the frequent experience that unwise investments of such funds have been made in the past and frozen assets rather than ready cash were on hand when the issues fell due. Such conditions lower the credit rating of the particular city affected, make further financing difficult and discredit municipal ownership.

This whole situation can be remedied by the more extended use of serial bonds which fall due in consecutive amounts each year and the whole issue limited to the useful life of the equipment. There are no sinking funds to invest, nor is there any possibility of unredeemed bonds remaining at the end of the useful life of the plant. Experience indicates that such bonds can be sold quite as satisfactorily as long-term bonds and are, hence, as desirable means of financing projects. Serial bonds seem, therefore, to be the proper securities to issue for municipally owned utilities as well as for privately owned plants.

There has been in the past, and there still exists, an overoptimism on the part of engineers and executives that leads to the assumption of too great a useful life for electrical plant. Cases may be cited where plant has been worn out and scrapped long before its estimated useful life had been reached. It is better occasionally—and rarely—to have all plant paid off while still in use than to have to replace worn-out plant against which securities are still outstanding. Engineers must revise their estimates of the useful life of electrical plant so that these are more in line with modern experience.

Another financial problem is taxation. There is no question that privately owned utilities are being heavily taxed. These taxes are one of the justifications offered for the present high rates of such utilities. Many people hold that the municipally owned utilities should be tax-free in order to provide service at the lowest possible rates. However, these utilities use public property for distribution purposes and have plant on land that, if privately owned, would be taxable. Furthermore, electrical service in the home, store or factory has a special value to the user rather than to the public as a whole. The user should pay in his rates a proper portion of the cost of providing that service over the municipal government's roads and alleys, which special charge is comparable to the taxation of the privately owned system.

Practice differs as to the form of payment in lieu of taxation of municipal plants. A common method is to turn over all yearly surplus funds of the utility into the City Treasury. This is not a satisfactory plan, for two reasons: First, there is the uncertainty each year as to the amount of the utility's contribution and, second, there is no inducement on the part of the city to cut rates when money can be more readily collected from a portion of its citizens in the form of electricity charges than as property taxes.

Professor Christie is well qualified to discuss private and municipal ownership of utilities in an unbiased manner. For a number of years he served as a consulting engineer with the Hydro-Electric Power Commission of Ontario and also for the Toronto Hydro. He was chairman of the Commission on Power for the Province of Alberta and served as consultant for Edmonton and other municipalities. In this country he has served as consulting engineer for several privately owned utilities and has been active in professional societies. We are glad to print his ideas at this time as a constructive contribution to important phases of utility developments.—Editors.

The proper method would appear to be the levy of taxes on the electrical property at the same rate as on private property. This would stabilize returns to the city's treasury and would lead to lower rates, since high earnings in excess of this taxation allowance could be returned to customers in the form of increased discounts on their January bills.

Many municipal plants do not maintain any surplus accounts. This is a mistake, for a surplus fund of reasonable amount is a useful reserve in case of an unexpected contingency such as fire, flood, cyclone or other emergency. The surplus can also be drawn upon to replace equipment which becomes obsolete rather than worn out before the end of its useful life. Surplus funds, where maintained in moderate amounts, are justifiable in municipally owned as well as in privately owned utilities.

Plant design and operation

PRIVATELY owned electrical plants have generally been designed for high economy and have been operated with much skill. Certain stations might be criticised for lavish expenditures in building and equipment.

In the case of municipal plants two difficulties arise. In the first place there is a hesitancy on the part of municipal administrations to secure engineering guidance from other than among the citizens of that city. This may prove a severe handicap when the city is small or has few experienced engineers among its inhabitants. The advice of an outside expert has generally proved valuable in the planning of a new plant or in its extension.

The second difficulty comes from the legal requirement, in some cases, to accept the lowest bid for equipment when new machinery must be purchased. It is recognized that various grades of equipment are available and that the most serviceable unit for a particular case is not always the cheapest. Some latitude in selection should be given those responsible for the purchase of plant equipment.

As noted in the opening paragraphs, the co-operative work of organizations such as the former prime movers committee of the National Electric Light Association, and the association of operating executives at its meetings for the exchange of experiences and the performances of the various systems, has been one of the greatest contributing factors in the remarkable progress in privately owned power plants. Unfortunately no similar organization exists for the operators of municipal plants. Hence these men experience difficulties in acquainting themselves with current progress and lack the incentives that come from comparing their performance records with those of other similar plants. There has been a reluctance on the part of municipal governments in the past to encourage their plant operators to travel around to attend professional meetings due to the neces-

sary expense. Operating engineers must be given a chance to see the latest developments in the art.

If performances of various municipal plants are to be compared, steps must be taken to standardize the method of keeping accounts and of presenting data. This has not been done in the past and each municipal plant record must be studied separately to learn the facts in regard to performance. This at times is difficult as complete figures are not always given.

Few privately owned utilities confine their operations within the boundaries of a single municipality, but serve suburban and even more distant communities. Such extension is economically justified, since this additional service can in general be furnished more cheaply from the large distributing system than from many small plants.

Municipals must broaden service

This circumstance suggests that municipally owned systems, if they are to afford the greatest economic benefit in any locality, must be prepared to extend their services to suburban and other adjacent areas, and also in certain cases to consider the purchase or interchange of power with other producers.

The extension of municipally owned services beyond the town boundaries may offer some difficulties from legal limitations, but these can be surmounted by proper legislation or by the organization of subsidiary electrical districts in the outlying sections which buy their power on a wholesale basis from the municipal system.

Municipal systems in the United States have been slow to avail themselves of interconnections with other electrical systems, although many advantages may be gained by such interchange. Interconnections with privately owned systems have in certain cases proved highly profitable and advantageous to both parties. This is particularly evident when one of the sources of supply may be low cost hydro power. Advantage may also be taken of supplies of surplus industrial power. All possibilities for purchase, sale or interchange of power with other systems merits the careful study of municipal officials.

Knowledge must replace guesses

It will now be apparent that many of the vital questions connected with municipal ownership of public utilities are those involving technical administration and financial control—questions that are entirely beyond the understanding of the average voter. Advocates of public ownership will do well to remember this, and if municipal control is secured they must be prepared to turn over such matters without question to those who are properly qualified and competent to deal with these problems. In other words, they must be prepared to substitute the exact knowledge of a trained manager for the guesswork of the average politician.

For successful municipal ownership of electrical utilities there must be a reasonable assurance that fulfillment of the following conditions may be expected: An absolute separation of politics from utility administration; a hearty spirit of friendly co-operation between the public and the utility; sound financial and accounting methods, and, finally, the most important consideration, a "one-man control" system with a competent trained executive in charge.

Oil Breakers Rated on New Duty-Cycle Basis

Under new joint recommendations breakers are methodically derated from more than two quickly consecutive CO operations. E.E.I., A.E.I.C. and N.E.M.A. co-operated.

Under a new schedule oil circuit breakers are to be rated upon two unit operations, each consisting of a closing of the breaker, followed immediately by its opening without purposely delayed action, with a fifteen-second interval between the unit operations. Any other number of unit operations or groups with other time intervals shall involve derating down to as low as 25 per cent for eight groups of two-unit operations at two-minute intervals. Provision is also made in the table for no delay between operations and for 0-15-60 seconds between them, with two-minute intervals between groups of operations.

This is the recommendation of a joint E.E.I.-A.E.I.C.-N.E.M.A. committee as reported by the chairman, George Sutherland, to the E.E.I. electrical equipment committee at the recent Cleveland meeting. This recommendation is now under consideration for adoption as an American standard by the A.S.A. sectional committee on power switchgear.

As a supplement to the previous report the following table (II), with explanations, was submitted at the meeting:

Oil Circuit Breaker Preferred Interrupting Ratings

The duty cycle of an oil circuit breaker shall consist of a specified number of unit operations at stated intervals.

Each unit operation shall consist of a closing of the circuit breaker, followed immediately by its opening without purposely delayed action.

The standard interrupting rating (standard duty cycle) of an oil circuit breaker shall be based on two-unit operations with a fifteen-second interval between operations.

Interrupting ratings for other duty cycles shall be as specified below:

Number of Groups	Total Number of Unit Operations	Percentage of Standard Interrupting Rating at Currents Specified: 0 to 5,000 Amp.	5,001 to 10,000 Amp.	10,001 to 20,000 Amp.	20,001 to 40,000 Amp.	Above 40,000 Amp.
		—Successive unit operations with 15-second intervals—				
–	2	100	100	100	100	100
–	4	95	95	90	85	80
–	8	85	80	70	55	50
–	16	75	65	50	35	—
		Groups of two (2) unit operations with zero* second interval between operations and two-minute intervals between groups				
1	2	90	85	75	65	60
2	4	80	75	60	45	—
4	8	70	65	50	35	—
8	16	60	55	40	25	—
		Groups of four (4) unit operations with 0-15-60-second intervals between operations and two-minute intervals between groups				
1	4	85	80	65	50	—
2	8	75	70	55	40	—
4	16	65	60	45	30	—

*Zero second shall be interpreted to mean no intentional time delay.

NOTE: It is intended that satisfactory performance of breakers will be obtained under the rating schedule suggested at rates of recovery voltage normally encountered in practice.

Hazards of Conductor Vibration Reduced

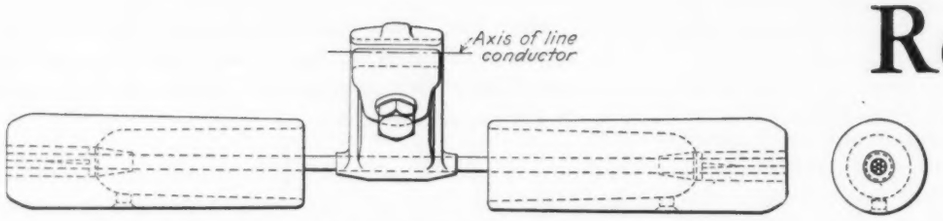


Fig. 1—Stockbridge damper absorbs vibration energy

By R. A. MONROE and R. L. TEMPLIN

Aluminum Company of America, Pittsburgh

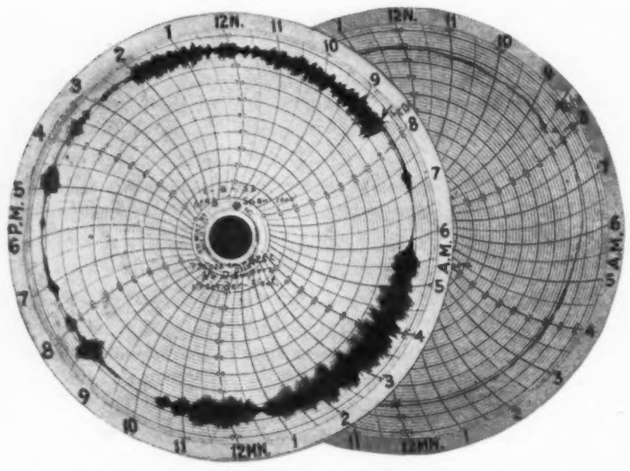
That long-standing menace to long-span transmission service, "dancing cables" or, less colorfully, resonant vibration, is well on the way to complete subjugation.

Either dampers or armor rods, one to suppress the building up of vibration amplitudes, the other to reinforce the cable where fatigue failure tends to develop, may be satisfactorily used.

TEN YEARS have elapsed since resonant vibration was first recognized as a hazard to transmission lines. The problem of protecting conductors from fatigue failure at points of support has since engaged the attention of both the operating engineer and the research laboratory. As is frequently the case, a practical remedy was first devised by the man on the job, after which it was analyzed and perfected by the research engineer.

Two satisfactory solutions, differing in principle, have been developed: One, known as the "Stockbridge damper," prevents the building up of any appreciable amplitude of vibration; the other, known as "armor rods," reinforces the conductor at the point where failure tends to develop.

The Stockbridge damper bears the name of the inventor, George H. Stockbridge of the Southern California Edison Company. This damper (Fig. 1) is simple in design, consisting essentially of two weights connected by a short length of suitable cable and attached to the transmission line a short distance out from the support. It is a remarkably efficient device, as is indicated by Figs. 2 and 3, which are 24-hour records of vibration for two cables of the same size, span and tension, one being free to vibrate and the other damped. Years of experience on thousands of miles of line have proved its success beyond question.



Figs. 2 and 3—Damping stops vibration on 795,000-circ.mil A.C.S.R.

A mathematical analysis of its action was developed by Dr. R. G. Sturm of the Aluminum Research Laboratories, which indicates that the damping results from the work done on the stranded cable which connects the weights. The analysis is too complicated to present here, but it proves that the damper will limit the amplitude of vibration to an exceedingly small amount. The theoretical curve for energy dissipation, which indicates the damper's efficiency, is not uniform over the entire frequency range, but has two distinct peaks, as is shown by Fig. 4, for a particular size of damper.

The design is not critical as regards proportions or location in the span, but an approximately correct selection of these factors is essential to best performance.

Damper cable design improved

Development of a satisfactory structural design for this damper involved a great deal of study and experimental work. The first models were designed without particular consideration of the stresses in the damper cable. Field experience indicated that through lack of proper design this stress was rather high, since occasionally a damper cable would fail at the point where it joined the weight. Mechanical tests on a machine especially designed to vibrate dampers proved that this detail was weak, since failure promptly developed in a few hundred thousand cycles at 0.1 inch amplitude. By means of test and mathematical analysis the design was improved without making any radical change in appearance or proportions to a point where the stresses are below the fatigue limit or where failure will not occur under an indefinitely large number of repetitions of stress.

When considering the effectiveness of dampers in protecting a conductor from vibration, the query arises

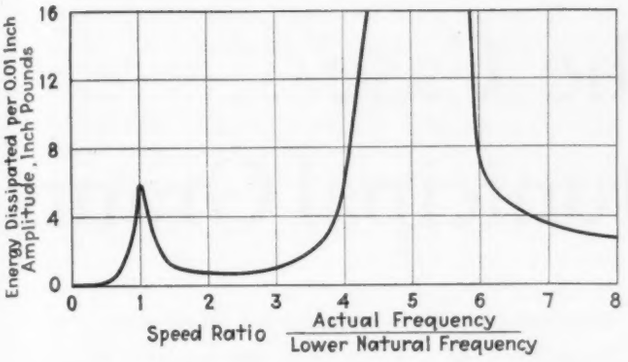


Fig. 4—Energy dissipation has peaks at certain vibration frequencies

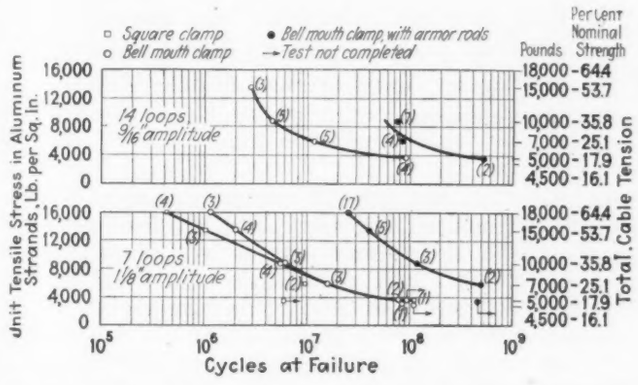


Fig. 5—Vibration cycles to failure decrease with stress on the cable with armor rods

Tests on 795,000-circ.mil A.C.S.R. (54 aluminum, 7 steel) on 120-ft. spans. Bell-mouthed clamp gives longest life, as high as 500,000,000 cycles at 4,000 to 6,000 lb. tension. Number adjacent to each point indicates the number of tests averaged to obtain that value.

as to the effect of the minute amplitude which develops before the damper can operate. This is of the order of perhaps one one-hundredth of an inch. Theoretical analysis indicates that such small amplitudes are not harmful, and this is proved by the available experimental evidence.

The ease with which dampers can be installed on operating lines constitutes a strong argument in their favor. No change of hardware is required, and a small crew equipped with properly designed hot-line tools can install them at very small expense.

Armor rods primarily reinforcement

Armor rods were developed from the idea of reinforcement, rather than damping. They increase the section modulus of the conductor, resulting in a larger radius of bending and lower stresses in the conductor strands. A partial damping effect results from the added stiffness of conductor at the ends of the span.

The efficiency of armor rods has been proved by an extensive series of purely relative laboratory tests on mechanically vibrated spans without attempting to give weight to their partial damping effect. Sufficient data have been accumulated to permit the plotting (Fig. 5) of the stress-cycle curves for representative sizes of A.C.S.R. These show the number of cycles required to produce failure under these arbitrary conditions for a wide range of stress, for cables with and without armor rods. The great increase in life when armor rods are used is readily apparent. These tests were performed using an amplitude comparable with the maximum observed in the field, and with a rigid clamp, whereas in practice such extreme amplitude is rarely experienced and the support is not rigid.

Since vibration failures are of relatively infrequent occurrence, in terms of the total mileage of constructed lines, it follows that a substantial reinforcement applied to a construction which is on the border line of safety should afford permanent protection. This conclusion is supported by the very satisfactory experience with armor rods installed experimentally in 1924 and, since 1927, on thousands of miles of conductors.

Vibration recorder available

Some lines experience very little vibration and it is frequently desired to make a vibration survey to determine whether any protection is necessary. Visual observation is slow, tedious and unreliable, and it seemed desirable to develop a recorder suitable for attachment to a hot line. A commercial type of auto-truck recorder was modified by the addition of a spring support to the pendulum and a suitable hot-line clamp. This instrument (Fig. 6) employs 4-in. charts, weighs less than 2 lb., complete with clamp, and records amplitudes on a small wax-covered chart to about one-third scale. A lighter recorder, using 3-in. charts and weighing less than 1 lb., has recently been developed. Either 24-hour or three-day clock movements and charts are available. The instruments, while not of the precision type, give very satisfactory records.

Generally speaking, transmission engineers are aware that progress has been made toward solution of the vibration problem. Many, however, do not realize the extent of the investigation and the success which has been achieved. Vibration breaks are still being discovered on some unprotected lines and in such instances the trouble will increase until some form of protection is installed. Theory and experience both indicate that armor rods or dampers will afford adequate protection and the installation of either is simple.

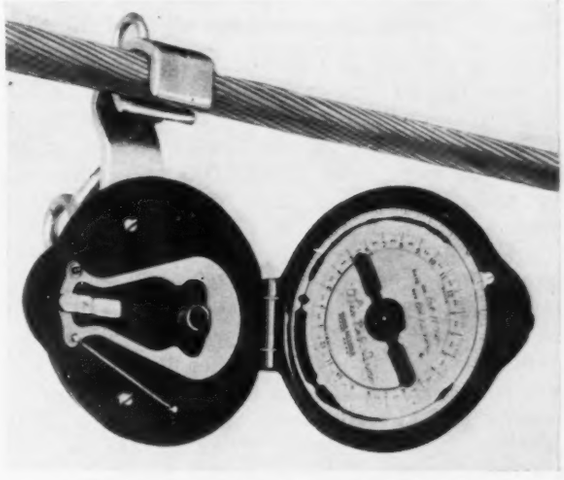


Fig. 6—Four-inch vibration recorder with case opened

Receivers State the Case Against P.W.A.-Municipal Grants

Specific arguments are always more convincing than general ones. Probably a great many private utility men can fluently recite the objections to governmental subsidizing of municipal competition, but only a few would be able to give definite facts and figures in support of their objections if they were challenged to do so. Because it gives form and definition to the pro-utility argument this article is published. It is an unchanged, unedited, except for sub-headings, presentation of a letter from the receivers of Middle West Utilities Company to the Illinois State Advisory Board of the Federal Emergency Administration of Public Works. The copy of the letter used for publication came from a public source. It was not released nor suggested for printing by the receivers of Middle West Utilities Company.

WE ARE advised that the city of Carbondale, Ill., now served with electric service by existing plants of Central Illinois Public Service Company, has made application for a federal loan and grant to finance a municipal electric plant and distribution system and that an informal hearing has been held.

As receivers of Middle West Utilities Company we have a direct and substantial interest in this matter as Central Illinois Public Service Company is a subsidiary of Middle West Utilities Company, and its very substantial investment made to serve the city of Carbondale will be destroyed if the application is granted. We consider it our duty as receivers to protest the granting of this application and desire to call to your attention the following considerations:

Central Illinois Public Service Company (for brevity referred to as the "company") has furnished electric utility service in the city of Carbondale since 1912, and during this twenty-one years has built up a substantial business there. Its service is conceded to be good, its existing capacity for present and all future needs is ample, and its rates are reasonable.

Service investment not all local

To serve the city of Carbondale exclusively the company now has an investment in excess of $260,000 in local distribution, street lighting and substation equipment and in addition an unallocated portion of an investment of more than $20,000,000 in generating stations and transmission lines serving generally the extreme southern portion of Illinois, including the city of Carbondale. The company's generating capacity in southern Illinois is concentrated in two large generating stations, one located on the Mississippi River at Grand Tower, approximately 20 miles west of Carbondale and in the same county, and the other located at Muddy, just north of Harrisburg on the Saline River in Saline County. The Grand Tower plant has a capacity of 60,000 kw. and the Muddy Plant 25,000 kw. These plants are connected by a double-circuit, 66,000-volt steel tower transmission line from which radiates an extensive transmission line system, over which the company serves in this extreme southern portion of the state 81 communities ranging in population from approximately 15,000 to less than 100, as well as coal mines and farms. Of the 81 communities served, 25 have a population of less than 500, 50 have a population of less than 1,000 and 60 a population of less than 1,500. Only nine communities served are above 5,000 in population and only three above 10,000. The southern territory served by the company includes the southern Illinois coal fields, many of the mines of which are wholly or in part electrified.

Harm to Illinois coal producers

ASIDE from coal mining, the territory relies almost exclusively upon agriculture. The company's business in this territory is made up of a combination of the business done by it in the larger cities, in the smaller communities, with the coal mines and with the farmers, each of these classes of business lending a substantial aid to the company's ability to carry on the others and each incapable of withdrawal without substantial impairment of the company's ability to serve the others. Withdrawal of the company's business at Carbondale alone would seriously impair the company's future operations in the territory and the ratio of this impairment to the remaining business would be increased with each succeeding withdrawal. Already competing municipal electric projects, depending upon federal aid, have been broached in West Frankfort and Harrisburg, two of the largest cities served by the company in this territory. Whatever may be the argument as to the effect of the loan and gift of federal public moneys to the half dozen larger cities in this territory for the construction of municipal electric plants, there can be no argument that such loans and gifts must inevitably be to the disadvantage of all the other consumers of electric energy in this southern Illinois territory served by the company. Higher costs must result to them, and this is equally, though less directly, true as to the remainder of the territory of this company, which serves with electric service 366 Illinois communities, most of them small in size, and extensive rural territory.

The company's generating plants in southern Illinois burn coal exclusively as fuel. In normal times the annual coal requirements of the company's Grand Tower station are in excess of 135,000 tons, all of which comes from mines located within 20 miles of Carbondale. The annual requirements of the Muddy station are in excess of 40,000 tons, all of which comes from mines located near that plant, but from the same coal field. The proposed municipal plant for Carbondale burns oil for fuel.

In taxes the company pays directly to the city of Carbondale more than $3,500 annually. In addition, it pays direct to Jackson County, in which Carbondale is situated, taxes in excess of $33,000 annually. These taxes are in addition to those paid in other communities and counties in Illinois and in addition to its capital stock tax and all federal taxes. All told, the taxes paid by this company will exceed $900,000 for the next year. Municipal electric plants do not pay taxes in the state of Illinois.

The company's local franchise at Carbondale expired in 1932 and has not been renewed. In 1930, at the city's request, the company installed an ornamental street-lighting system at a cost of more than $17,000, with the understanding that a twenty-year franchise would be granted. The City Council granted the franchise, but at an election held in 1930 the required approval of the voters was not obtained. However, the company has a ten-year street-lighting contract with the city, which has still seven years to run. Also, it has a contract to supply all electric energy required in the operation of the city's pumping plant until 1936.

No question of service or rates

The service rendered by the company at Carbondale is conceded by the city to be good. Service can be rendered over each of three separate transmission lines forming parts of the company's transmission system in this territory. The installed capacity of the Grand Tower and the Muddy stations is ample to serve the needs of this territory for years to come.

No controversy exists as to the rates. In fact, the rates proposed to be put into effect by the city of Carbondale, notwithstanding its exemption from taxes, are substantially the same as those the company now has in effect. The report and estimate on which the city's action is based contemplate no reduction in rates during the next ensuing sixteen years. Since 1923 the average amount per kilowatt-hour paid to the company over its territory as a whole for residential and commercial service alone has decreased approximately 50 per cent. The company has obviously pursued in normal conditions a policy of rate reduction.

The rates of this company are subject to complete regulation by the Illinois Commerce Commission. Its present rates do not produce a fair return upon its investment used. It is unable to pay any dividends on its common stock for the past six months and has been able to pay only one-third of the current dividend on its preferred stock. The holders of its preferred stock, of whom there are more than 20,000 residing in Illinois, have furnished more than 25 per cent of the money invested in the company. The destruction of an important part of the company's business will still further injure the position of these stockholders.

The question here involved, as we see it, does not concern the merits or demerits of municipal ownership. It is a question of whether the federal government will invest in and donate to such enterprises public moneys paid in by taxpayers over the country at large where the effect is to destroy existing investments. We cannot believe that a program designed to promote recovery from a serious business depression could have been intended to destroy investments in property which is now furnishing good service at moderate rates and giving employment to many persons, or that such destruction can, in fact, promote recovery.

Informal opinions on present conditions and problems confronting the industry are helpful. We welcome to this forum the type of discussion presented by Mr. Daniels and hope others will discuss industry questions here in a similar constructive vein.—EDITORS.

Julius Daniels calls for—

President of the newly formed Air-Conditioning Bureau of Boston; assistant superintendent promotion department, Boston Edison Company.

Local bureaus to push air conditioning and meet public interest with a market

The man in the street is talking about air conditioning. He is intensely interested in inventions and developments making for bodily comfort. Progress in automobile design and in radio no longer monopolize his attention. In this virgin field the public utility is offered an opportunity to multiply the value and satisfaction of its service to the consumer. Increased use of electricity on a large scale appears on the horizon.

Popular acceptance of air conditioning must result from the wholehearted entrance into the field of manufacturers of national eminence, with the irresistible force of their long experience in promotion and sales activities. The best local results have occurred where the greatest effort has been made by the local utilities and manufacturers' representatives. The best immediate results hinge upon the co-ordination of such efforts.

Air-conditioning bureaus should be formed to aid and direct the sales efforts of community groups. Such bureaus should carry on local publicity work of the type which usually depends on the initiative of distributors. By adequate exhibits, mailed material, radio, billboards and other publicity local sales forces will sense and profit by continuous backing of the organizations striving to bring this new form of service to public acceptance. They will have the feeling, always stimulating, that the necessary missionary and publicity work is being done to encourage their best efforts as well as to win the public to desire and appreciate the newly available facilities.

Formerly many campaigns of national scope have succeeded because of thorough local organization. The same results are assured if similar methods are followed in the development of the air-conditioning market.

Escape the Spare-Parts Problem

By PAUL S. HAMILTON
Assistant General Storekeeper, Detroit Edison Company

Tradition, and the inherent caution of the man whose function must not fail, has led to unnecessarily large spare-parts supplies on many properties.

Methods of control to prevent the accumulation of large stocks of materials in electric utility warehouses were described by Mr. Hamilton in the "Electrical World" of January 20. How to get rid of materials left over from construction was his theme in an article published February 24.

Now he turns attention to the chronically vexatious problem of spare parts, shows how these insurances of continuous operation can be kept within reasonable bounds yet save the storekeeper from the execrations of the operating engineer.

"HEAVEN'S gift to the operating man so he can get a full night's sleep." In these words a former controller of a large Eastern utility once described spare parts to the writer. If this is true, then in many cases a yard was taken when an inch was offered and more than a few chief operating engineers might qualify as Rip Van Winkles from the amount of sound sleep at their disposal. An old saying goes, "He was land poor." This might be paraphrased to fit many utilities that they are spare-parts poor.

During and following the war were the halcyon days for the manufacturers who sold spare parts to utilities for any and every service. These parts were purchased with an eagerness that suggested that manufacturers were none too sure their equipment would stand up, and utility operating engineers were sure it would not. There were other reasons, of course, one being that accurate descriptions of spare parts in stock were so rare that all unwittingly some purchases were made when sufficient parts already reposed in the warehouses. Another reason was probably due to buying parts too liberally at the time the piece of equipment was purchased and before having any operating experience with it. Equipment manufacturers naturally enough desire to obtain the largest possible order when selling equipment and nothing is more natural than to try to sell plenty of parts at the time of the equipment sale. Our own engineers now admit that we have sometimes purchased spare parts somewhat after the fashion described above.

Times change, and with the deepening of the depression it became absolutely essential to watch more carefully the purchase of all material and supplies, including spare parts. Most utilities purchase both equipment and spare parts on fixed capital work orders. On the Detroit Edison system requests for all spare parts to be purchased for any equipment originate in the office of the construction engineer and are put on bills of material separate from those of the equipment they are intended for. The ordering descriptions are made as complete and accurate as possible and the parts bills are then sent to the stores department. Here they are gone over to see what possibilities there are for supplying the parts from stock. In the case of new and heretofore untried equipment this is obviously impossible, but in the case of adding another unit of existing equipment we have many times been able to show the operating men that we had spares on hand and in sufficient variety and number amply to take care of the additional unit.

Time for something to be done about it

Such a state of affairs did not exist when we began a comprehensive and company-wide study of spare parts. There was no catalog or centralized list showing exactly what the correct description was and to what existing machines or equipment these existing spare parts applied. Spare parts had been purchased largely during the period of the war and directly after, when worry over possible breakdown of overpushed machines became the constant nightmare to power plant and substation operators. As a result, we found ourselves with an excess of spare parts and with no definite and planned way of knowing how many were really needed to provide adequate protection for the service at a reasonable cost.

Inventory and analysis made

THE first step was to sell the idea of a spare-parts study to the engineers in charge of power plants and substations. We were fortunate in obtaining not only their consent but the direct assignment of one of their men to work with us. A young mechanical engineer with some power plant experience and a keen and alert mind was assigned by the stores department to work with this man. The method of attack was simple and direct.

As the first step they went over all existing spare and maintenance parts in warehouses and in the small "private" stocks built up by cautious plant engineers at their respective plants. Later, these "private" stocks were put into the material and supplies account and the statement made that the stores department would in future carry all such stocks in the warehouses with a unified control.

When this survey was finished the two engineers next obtained the most accurate descriptions possible for each item. Then each item was compared to each existing piece of equipment in order to see if duplications existed, or if a part was on hand for equipment that no longer was in operation. Next a simple catalog was made up

containing all this information in order that not only the stores department but all operating and maintenance men might know exactly what was in stock, where it was warehoused and for what equipment it could be used. As the so-called "private" stocks were done away with, their contents were classified in the same way and so the unified spare parts system came into being.

The accounting department helped not a little by arranging the monthly statement of material and supplies on hand, so that spare parts were shown as a distinct and separate item (by classes). From that time on the stores department was able to tell the management exactly the value of this slow-moving investment in spare parts. This was done by classifying them into a group with serial numbers beginning in "8" or "9." For example, take a "thrust collar, steel," for the circulating pumps on house alternator units 1–2–3 at Trenton Channel power plant. The stock number assigned was 470–9082. This class 47, according to the Detroit Edison Company's classification, is for pumps and compressors, the subclass 0 is for pumps and the serial number 9082 is the steel thrust collar. The fact that the first digit of the serial number is 8 or 9 identifies the item as a spare part. In the tabulating machines of the accounting department, with its modern and efficient system, a card punched 470–9082 or any other 9000 or 8000 card can be sorted out of the nearly 14,000 cards, representing the stock items carried. Thus, once a month we know exactly where we stand on all spare parts.

How the system works

As described in a previous article on control methods,* a plant engineer wishing to order spare parts has his clerk write out a stock questionnaire, giving the stock number, brief description and amount wanted. When this is received at the stores department office the engineer charged with the control of spare parts checks the amount against his record of amount on hand. If there is sufficient on hand, but at another power plant, he does not buy, but transfers the parts by truck. If he cannot do this he sends his permanent requisition through to the purchasing agent.

"The proof of the pudding lies in the eating." During 1933 questionnaires, or requests to buy spare parts, to a value of over $10,000 were received by the stores department office and either turned down or supplied from existing stocks. Formerly, this could not have been accomplished, and its success arose not only from a good catalog and efficient system but more from the sound co-operation and backing given by the chief engineer of power plants, superintendent of the electrical system and other operating executives. In the final analysis they are the ones who say yes or no to the purchase of spare parts and we can only supply them with accurate data to enable them to arrive at a sound decision. Many times during the troubled days Detroit went through in early 1933 we have gone to these men about spare parts and suggested that such and such a part existed in an idle machine or idle position of a substation. We often obtained the needed part from this source and canceled the request to buy. Later, when the load comes back, it may be necessary to buy some of these "robbed" parts, or the load may shift to another area and thus obviate such a financial expenditure.

* See ELECTRICAL WORLD, *January 13, 1934, page 83.*

Protection of parts in storage

A WORD here may not be amiss on the storage and care of spare parts. Since they are really insurance for continuity of operation, it is essential that they be in good condition at all times. One of the important phases of storing is the protection of the machine surfaces, which may be subject to corrosion while in the warehouse. Parts received from the manufacturer are usually coated with some sort of material for this purpose. However, parts which are returned to stock after being reconditioned usually require some sort of protective coating, and both new and used parts require renewed coating after a period of time in storage, due to handling. This protective coating must be of such nature that it will endure while the parts are in storage, yet be readily removed by solvents when the parts are put into service. Various types of coatings have been used. These may be divided into (a) hard drying and (b) non-drying.

The hard drying coatings, such as tallow and white-lead mixture, clear pyroxylin, lacquer or other paint mixtures, give a lasting protection provided there is no chance of scaling or scraping the coating off through contact with other materials, crating, blocking, etc. The non-drying coatings, which include greases of varying consistencies, offer the undesirable feature of becoming soft in warm weather and running off the parts onto the warehouse floor or shelving. On the other hand, surfaces coated with greases are not likely to be wiped clean and dry unless some solvent is used, thus the coating will usually last longer while the parts are in storage. There is a heavy grease product (gear compound) which can be thinned with kerosene and applied with a brush. This compound will then "set" into a stiff, rather hard, consistency which will not easily run off during hot weather. Such a coating is readily dissolved off with the use of kerosene when the part is put into service.

Today we find ourselves steadily weeding out any surplus of spare parts either by slowly using them up or by systematic scrapping when the machines they insured are taken from service. Sometimes we hold them in salvage with the machines they might have repaired and which are offered for sale. Frequently a sale is thus at a higher price because the buyer is afforded additional protection. Mostly they go to scrap, as all good machines must eventually do in this age of rapid obsolescence. We now buy spare parts only as needed and when we buy we know we are getting protection at the right point and in the right amount. We now have only about $940,000 so invested, which, in comparison with what the investment in spare parts used to be, is very reasonable for a system of this size.

Decline in Dollar Value of Spare Parts*

The Detroit Edison Company

January 1, 1931	$1,024,000
January 1, 1932	975,000
January 1, 1933	946,000
March 1, 1934	934,000

*These figures are significant less as an indication of spectacular reduction by any sweeping program than as showing the steady decline brought about by continuous and consistent adherence to a well-calculated plan of control.

Vacuum Contactor Fireproofs Switching

By W. K. RANKIN
and C. D. HAYWARD

Switchgear Division,
General Electric Company, Philadelphia

Sealed in a vacuum tube, the contacts of this new circuit interrupter, rated 250 volts, 15 amp., have been operated 10,900,000 times without failure under actual operating conditions.

A LOW-VOLTAGE vacuum contact device of new design may be operated electromagnetically by the motion of a relay armature, mechanically by means of either an electrical or manual mechanism or thermally by the bending of a bimetallic strip. It is not affected by vibration or shaking and can be operated in any position.

Since the arc is confined in the tube it cannot ignite inflammable gases, vapors or dust which may be present in the atmosphere in such places as refineries, dry cleaning plants, flour mills, grain elevators, etc. Nor is there present any inflammable material in its make-up to originate fires.

A high vacuum is an excellent insulating medium, better than any known substance. Its arc-quenching quality is of the highest order and it requires only small contact separation to effect circuit interruption, thus a relatively small operating power is required and high speed of operation is obtained. The contacts, not being exposed to the air, cannot oxidize or tarnish and, being inclosed in a sealed tube, cannot collect dust or dirt, and so the original low contact resistance remains practically unchanged without requiring maintenance.

Contact sticking, inductive kicks prevented

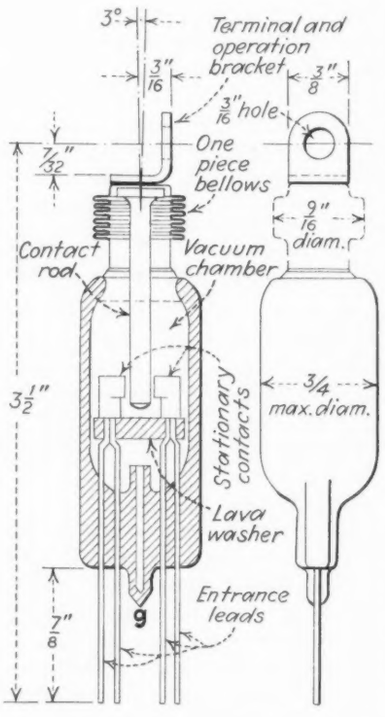
Electrical contacts in a vacuum exhibit several characteristics not found when they are placed in other mediums. Contact sticking (not welding) is a particularly serious problem in a vacuum because the clean condition of the contact surfaces promotes adhesion when they are pressed together. In addition, the contacts tend to interrupt currents more sharply than in any other medium, and therefore are likely to produce higher voltage surges when switching highly inductive circuits.

It was found that making one contact of vacuum-treated copper and the other of a copper-silicon-manganese alloy was effective in preventing sticking and reducing voltage surge, and at the same time gave satisfactory current interruptions and long life. Vacuum treatment of contacts is necessary in order to prevent the emission of gases after the tube is sealed off, which would impair the vacuum.

The tube is pumped down to a pressure of approximately one-millionth of an atmosphere. This high degree of vacuum tends to improve rather than deteriorate with the use of the tube. The minute quantity of metal vaporized from the contacts each time a current is interrupted condenses again on the walls of the tube, sweeping up, as it does, traces of residual gas. The action is similar to that of the "getter" commonly used in the manufacture of radio tubes for obtaining high vacuum, except that, whereas in the case of radio tubes the "getter" is flashed only once during the process of manufacture, in the vacuum contact tube the action is repeated each time a current is interrupted.

In order to prevent the vacuum from being impaired because of the emission of gas after seal-off, all materials in contact with the vacuum have been selected because of the ease with which gases absorbed in them may be driven out by baking during the exhaust process.

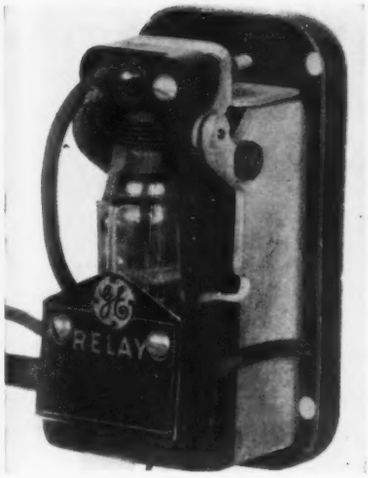
A convenient method of testing vacuum in the device described, and one which demonstrates its high dielectric strength, consists in connecting the terminals of a spark coil to the two pairs of leads. If the proper vacuum exists the spark will jump the $\frac{1}{4}$-in. gap between wires outside rather than the 0.02-in. gap inside. This requires a potential of approximately 10,000 volts. All vacuum contacts after having been sealed off a sufficient time are tested in this manner to detect leaks.



Unit is rated at 250 volts, 15 amp., with a breaking capacity placed conservatively at 10 amp., 230 volts a.c.; 15 amp., 115 volts a.c., and 10 amp., 250 d.c. Vacuum chamber is formed by a heavy walled glass tube to which is sealed a one-piece metal bellows, forming a flexible member which allows a swinging motion of the contact rod. Bellows is made of an alloy having a thickness of 0.005 in. and requires little force to flex it and yet is strong enough and has sufficient fatigue resistance to withstand millions of operations. A bending moment of only 2 inch-ounces applied to the small bracket is required to swing the movable contact and produce sufficient pressure on either throw.

Two stationary contacts are swaged on and supported by the entrance leads and separated by the lava washer. When the rod contact rests against one stationary contact it leaves a gap of only 0.02 in. to the other stationary contact. This gap is more than sufficient in the vacuum to interrupt the current and maintain sufficient insulation between contacts for the rated voltage of the device. Except for mechanical reasons this gap could have been made much smaller and still meet all requirements.

Single-pole, double-throw vacuum contact device, safe for explosive atmospheres



Auxiliary relay employing vacuum contact device

Operating current of this relay required is only 0.04 amp. at 125 volts d.c. Relay may be adjusted to pick up with as little as 0.3 watts, if desired.

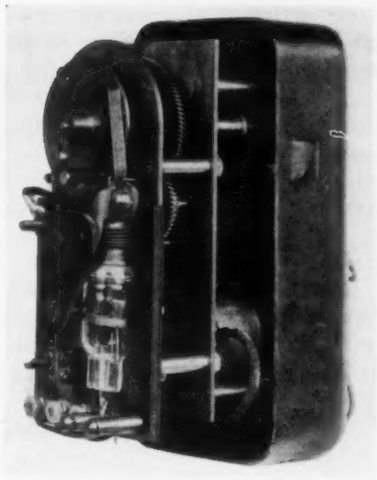


Plate circuit control relay with contact device is used in connection with "Thyratron" tubes

A voltage surge caused by the opening of an inductive circuit is, of course, not uncommon, but because of the very rapid opening of the circuit it is more severe in connection with a vacuum contact device. While the severity of the voltage surge is reduced by the choice of proper contact materials further to reduce it to a safe value for insulation, on either an a.c. or d.c. circuit, a condenser should be connected across the load terminals of an inductive circuit when the vacuum contacts are required to open the circuit.

Very small condensers connected across the vacuum contact terminals are also used for higher current non-inductive d.c. circuits in order to reduce contact burning and so insure longer life. Such a condenser is not required across the contacts when used to open an a.c. circuit, whether inductive or non-inductive. In the case of the a.c. inductive circuits the condenser required across the load terminals serves both purposes—that is, to cut down voltage disturbance and to protect the contacts.

In actual test a contact device of the construction described operated 10,900,000 times without failure, interrupting a slightly inductive circuit of 5.6 amp. at 250 volts d.c. It was actuated at the rate of five times per second, eight hours per day, five days per week, for more than six months. A 0.005-mfd. condenser was used across the contacts.

Why Neglect Half the Customers?

By DAVIS M. DeBARD

Chairman E.E.I. Table Cookery Committee
Sales Engineer Stone & Webster Service Corporation

In forming a committee to push table cookery devices* power company sales managers and manufacturers recognize that "less than 50 per cent of our residential customers are prime prospects for major devices."

ONLY increased sales can compensate for the rate cuts that have been made and for the increases in operating expenses and taxes that will have to be met during the next few years. The urge to increase rapidly energy output for residential consumption has influenced operating companies to center attention on the major load builders. Notable success has been attained with the electric refrigerator. The electric range had its maximum yearly sales in 1930. The electric water heater has been growing in favor. But when we analyze our market we find that less than 50 per cent of our residential customers are prime prospects for these major devices.

An analysis by the statistical department of the Edison Electric Institute of the energy use in homes in 1929 brought out that 58 per cent fell below the line of "minimum of comfort" in living. Of this number approximately 6,000,000 used an average of 20 kw.-hr. or less per month and another 4,000,000 used less than 30 kw.-hr. per month. The same analytical survey indicated that 5,250,000 used from 30 to 50 kw.-hr. per month and that 3,000,000 households used more than 50 kw.-hr. monthly. This group included the well-to-do and wealthy classes.

In 1929 the average annual use of approximately 13,450,000 customers was 268 kw.-hr. annually.

A more recent analysis of domestic consumer use in the large cities indicates again that 45 per cent used less than 30 kw.-hr. per month and 70 per cent of the total used less than 50 kw.-hr. per month, the national average. In another city 52 per cent used less than 30 kw.-hr. per month. That is, we are faced with the cold facts that approximately 50 per cent of our consumers used less than 360 kw.-hr. annually. Another study shows that upward of 9,000,000 residential customers are paying from $4 to $6 per year less than actual cost to serve, plus a fair return. A survey recently made for one of our operating companies reveals 500 families in class 1, 1,600 families in class 2, 5,400 families in class 3 and 18,500 families in class 4, or a total survey of 26,000 families. The predominance of families in the low-income group is somewhat explained by this being a manufacturing town, but I believe we are safe in assuming that from such statistics as are available more than 50 per cent of our residential customers would be recorded in the low-income group.

In our load-building job in the home, therefore, we

**Excerpts from paper presented before the recent E.E.I. Sales Conference in Chicago.*

cannot depend upon any one device or group of devices. We have too many classes of consumers and too wide variations in spending margins to expect that refrigerators can do the job alone or ranges and water heaters will give us the final answer. We must increase our lighting load, which is now being given attention. We must make an appeal to that great class of smaller, non-profit consumers to use more service through the smaller appliances which they can afford to buy. For this reason it has been recommended that this is an opportune time for the industry to turn its attention to the group of able cookery appliances which give a useful service in the kitchen and dining room. A customer can afford to operate most of this cookery group on the middle steps of our inducement rates. The use of one or two small heating devices can easily make profitable many low-use customers now served at a loss. An activity *now* on small appliances will put to work many pieces of equipment shelved during the depression years or will replace those, now idle, that should have been replaced months ago.

Dealers should welcome this program. About a year ago the dealers in one large community asked their central station to go back into campaigning of table devices. They had observed that their sales had declined due to lack of utility promotional work. The company granted the dealers' request and has been running monthly campaigns on small appliances with splendid results. The duration of this effort is for six months beginning in March.

The Edison Electric Institute has appointed a small committee for quick and effective action to carry through a table cookery program built up somewhat along the lines of the Better Light—Better Sight Campaign. This committee consists of C. E. Swartzbaugh, president Swartzbaugh Manufacturing Company and chairman of the Domestic Appliance Section of N.E.M.A., R. W. Turnbull, General Electric Company; F. R. Kohnstamm, Westinghouse Electric & Manufacturing Company, and C. E. Greenwood of the headquarters staff. I have the privilege of being chairman of the committee.

Like the lighting program, we are not to have any national advertising; we are not going to have a national "campaign"; we are not attempting to lay down sales plans, nor influence any company on the time for selling and promoting these table devices. We are going to urge utility companies, department stores, hardware stores, furniture stores and others selling small devices to engage actively in the promotion or selling, or both, of the smaller quality heating and motor-driven devices generally used in the kitchen and dining room.

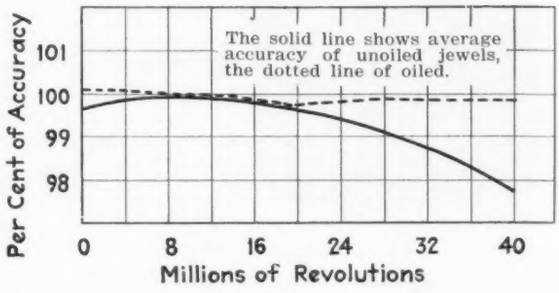
Electric tableware for the past three years has been taken for granted. Many power companies have given up the sale of the smaller appliances. Others have given up advertising them. Sales have dropped appreciably during the past two years, and I believe with the drop in advertising many homemakers have lost their interest in use.

This is a joint effort with the manufacturers. They are contributing equally with the institute to the expense of this program through individual subscriptions.

There is no intent to promote campaigns that will arouse any antagonism on the part of the trades; in fact, they have all been invited to join nationally in the program through contact with their national associations. We expect that all sales and promotional programs in local communities will be co-operative.

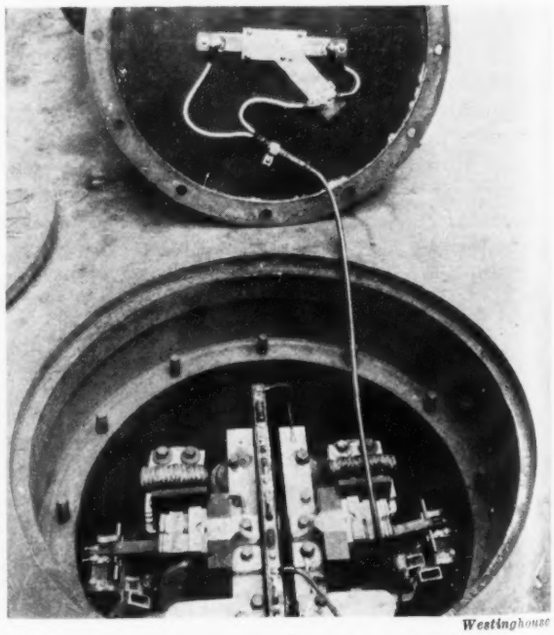
· · · INDUSTRY

Oiled Jewels Winning in Meter Bearing Test



For about three years now two test groups totaling 68 watt-hour meters have been running continuously in the meter laboratory of the Kansas City Power & Light Company. The jewel bearings in one group of meters were oiled at the start and in the others were not. Up to now the meters in the check have turned about 40,000,000 revolutions. The meters containing the oiled jewels are still practically correct, while those containing the dry jewels began to slow down at about 10,000,000 revolutions, and are rapidly becoming slower. No doubt when this test is completed (it will run at least five years) a number of more definite conclusions regarding jewel oiling will be reached, but the results so far do not leave much doubt regarding the value of oil in the meter jewel under the conditions in which these meters are operating.

No Sweating in this Manhole


Westinghouse

A 250-watt space heater and thermostat maintain correct temperature in the manhole and prevent condensation on the cover.

PRACTICES IN BRIEF · · ·

How to Guard Against Faults in De-energizing and Phasing

In canvassing unusual hazards to equipment a committee of the Northwest Electric Light and Power Association has found troubles to arise from open fuses on high-voltage potential transformers, from phasing across high-voltage disconnecting switches and from single-pole disconnecting switch operations on high-voltage power and potential transformers. Reporting to the association, Messrs. C. E. Cannon and J. S. McNair of Washington Water Power Company submitted the following general conclusions as well substantiated by the operating companies of the Northwest:

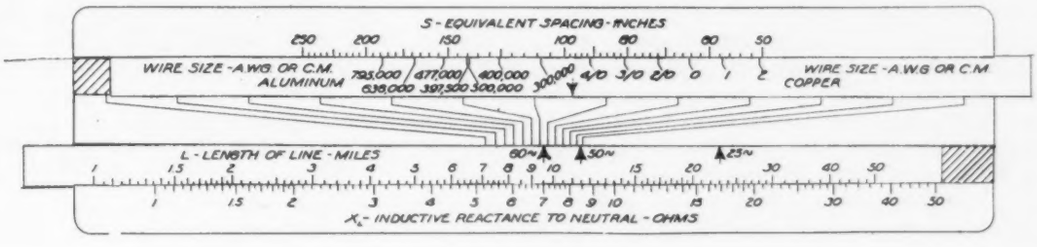
1. Energizing or de-energizing power transformer banks or potential transformers by means of single-pole disconnecting switches may in some cases result in resonance and consequent hazard to insulation of equipment from high voltage and should be avoided when possible.
2. Phasing high-voltage systems by means of potential transformers connected across open disconnecting switches may result in high voltage from resonance and, where possible, other means should be used in phasing.
3. Avoid station designs whereby the operation of single-pole disconnecting switches can place a potential transformer in series with a length of cable with the possible result of series resonance.
4. The danger from resonance in potential transformers can be minimized by adding a resistance burden to the potential transformers. This is not always feasible, as the resistance burden in combination with the normal burden may overload the transformer.
5. Frequent and thorough inspection of the condition of high-voltage potential transformer fuses is necessary to guard against incorrect voltage and phase-angle indications due to an open fuse on open delta potential transformer banks.

Reactance Slide Rule— Any Wire, Spacing, Miles

By J. N. ARNOLD
Instructor Engineering Drawing, Purdue University

At Purdue University the engineering extension department has been mapping slide rules for many special purposes. One of these, described in a recent bulletin (No. 32) giving mathematical evolutions, makes it possible to determine the reactance of a transmission line without resort to tables or computation. It covers the range of conductors from No. 2 to 795,000 circ.mil ACSR, of spacings from 50 to 250 in. and lengths up to 50 miles. All three frequencies 60, 50 and 25 cycles, are represented on the rule.

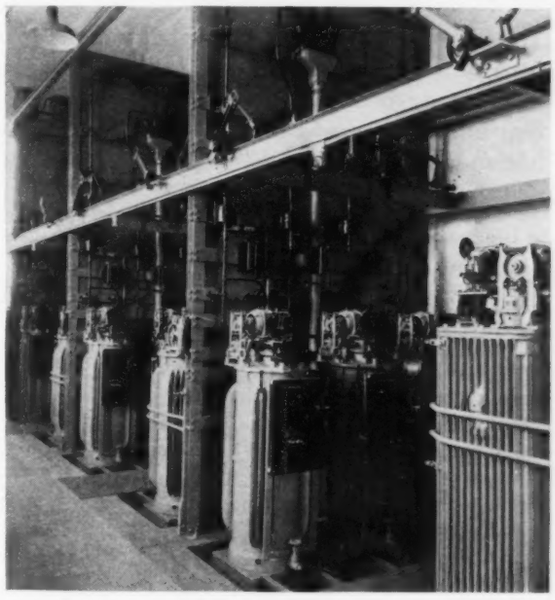
In operation (1) the wire size on the upper slide is set opposite the equivalent spacing, (2) the frequency arrow on the lower slide is set to correspond (through the medium of the middle transfer lines) with the arrow on the upper slide and (3) the reactance ohms are read opposite the line length.


S - EQUIVALENT SPACING - INCHES
250 200 150 100 80 60 50
WIRE SIZE - A.W.G. OR C.M.
ALUMINUM
795,000 636,000 477,000 397,500 400,000 300,000
4/0 3/0 2/0 0 1 2
WIRE SIZE - A.W.G. OR C.M.
COPPER
L - LENGTH OF LINE - MILES
60~
50~
25~
1 1.5 2 3 4 5 6 7 8 9 10 15 20 30 40 50
1 1.5 2 3 4 5 6 7 8 9 10 15 20 30 40 50
X_L - INDUCTIVE REACTANCE TO NEUTRAL - OHMS

Slide rule gives reactance in two operations

As set in the illustration a reactance of 11.1 ohms to neutral is found for a 60-cycle, 15-mile line of No. 2/0 copper at 72 in. equivalent spacing.

Boston Banks Regulators for Unified Operation



By symmetrically grouping feeder regulators in open compartments separated by transverse barriers of fibrous material the Connecticut Power Company has accomplished an unusually well-unified wiring, instrument transformer and disconnecting switch layout from the standpoints of construction and inspection at its main substation in New London. Six regulators were installed in each compartment, three being mounted on each side of the barrier and well separated from the others of the group by the liberal clearance in air space shown within each compartment. Current and potential transformers were mounted on horizontal steel bars on each side of the barriers and gang-operated disconnecting switches were mounted above these transformers on cross-framing between the regulators and the potheads of the outgoing cables, giving a compact wiring layout and avoiding complication in identifying conductors at all times.

The operating lever for each group of disconnects

was mounted on the transverse I-beam at the front of the regulator compartments. Wells for emergency drainage of oil from the regulators were provided around and below the concrete pedestals supporting the regulators and flat rails composed of angle-irons facilitate the rapid removal of any regulator in case repairs are necessary. The compartment framing and space allotment enable regulator sizes and wiring to be changed at any time at nominal cost.

Utility-Provided Unit Corrects Power Factor

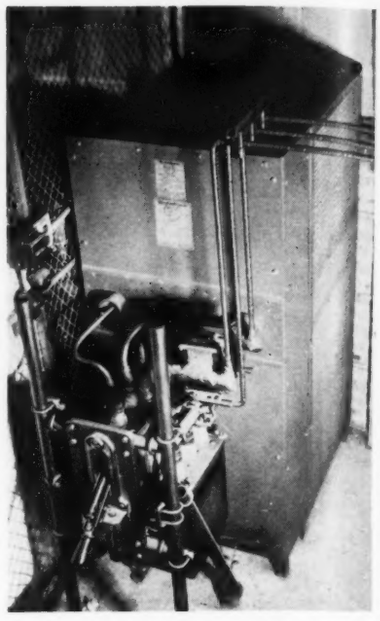
This power company, faced with an industrial plant problem in poor power factor, installed a capacitor at its own expense. Through payments out of savings in fifteen months the factory owned the capacitor and now profits by the reduced power bill.

By E. C. STOEVER
Sales Department, Westinghouse Electric & Manufacturing Company, Milwaukee
and A. N. LENDMAN
Power Sales Engineer Wisconsin Gas & Electric Company

Soon after being placed in operation in July, 1930, an unexpected problem of poor power factor was encountered in the new plant of the Snap On Tool Company, Inc., manufacturer of high-grade socket wrenches, at Kenosha, Wis. A capacitor solved the problem without ultimate cost. The plant is served from a 26,400-volt, 60-cycle transmission line, energy being purchased on the primary rate of Wisconsin Gas & Electric Company, metered on the high-voltage side of the plant substation. The power company has a demand rate with 80 per cent power factor as standard, below which the customer is penalized and above which the customer earns a bonus. Average monthly power factor as measured by a reactive-kilowatt-hour meter, without ratchet to prevent reverse registration, is used as the basis of power factor calculation.

After the first month of operation the plant showed an average power factor of 70.7 per cent and for the following month, with the same energy consumption, the power factor had dropped to 65 per cent. A survey of the plant by the utility's engineers, using a portable power-factor meter, revealed that the power factor of a 170-kw. electric drawing and hardening furnace was lower than might have been expected. A check-up of this piece of equipment showed improper connections of the air-cooled single-phase transformers supplying the furnace, which resulted in unequal distribution of the load on the three phases. By correcting this condition the average power factor of the plant was brought up about 5 per cent.

The plant was not operating at full capacity and the survey showed that the low average power factor was mainly due to the fact that induction motors driving group machine line shafts were lightly loaded, resulting in a large reactive load. Notwithstanding the fact that a 100-hp. synchronous motor, driving an air compressor, had been installed, it was impossible to do any more to reduce the reactive load, with the equipment as installed. It was not practical to change the sizes of motors to load them up more and thus improve power factor. The motor equipment had just been purchased and changes would have meant a great loss. Likewise, it was not possible to forecast industrial conditions which might have a bearing on the situation.



Reduced bills paid for this 90-kva. capacitor in fifteen months

The practical solution to the problem was the installation of capacitor corrective equipment. Calculation showed that 90 kva. of capacity would just compensate for the reactive kilowatt-hours and produce an estimated saving in the power bill of $130 a month by bringing the average power factor to unity. On this basis a capacitor costing approximately $1,950, installed, would pay for itself in savings in just fifteen months.

A 90-kva., 480-volt, three-phase Westinghouse type LD group type capacitor was installed, connected directly to the main service entrance switch of the plant. The Wisconsin Gas & Electric Company paid for the installation initially. Power bills were rendered on the basis of the previous low power factor and the difference between this and the actual bill was credited to the Snap On Tool Company against the purchase of the capacitor. The estimated saving was realized, so that in fifteen months the capacitor was paid for; it then became the property of the tool company, and from that time on the equipment has been earning a substantial reduction in power costs.

New Range-Use Plans Prove Highly Effective

Range rentals at Hartford and trial installations at Detroit add load four and ten times as fast, respectively, as previous methods.

Proof of the soundness of range stimulation plans as a method of getting heavy appliance loads on the utilities' lines is shown by the results of the first year of operation of the Hartford range-rental plan and the first 4½ months of the trial installation plan of the Detroit Edison Company in certain of its territories outside the city of Detroit proper, which was the sequel to a similar plan open to employees begun a year ago.

Under the Hartford plan (ELECTRICAL WORLD, February 4, and June 24, 1933, pages 151 and 809) the number of customers added in 1933 was 1,415, as compared with 323 in 1932. Also, in 1933, 260 ranges

were sold by dealers compared with 175 in 1932, because the dealer was permitted to give a discount equivalent to the rental waiver for the time left till June, 1934. Ranges were sold to 102 customers who started to rent and decided to buy.

In the 4½ months of operation of the Detroit Edison range-trial plan from October 17, 1933, the plan resulted in 1,733 new range installations, of which 173 were outright sales, as compared with 318 sales in the first 9½ months of 1933, or a relative increase of 1,000 per cent in the rate of adding this type of load. Under this plan two different ranges are offered for six months without down payment, installation charge or commitment to purchase, at a trial charge of $1 or $1.25 per month with the option of purchase of the range at any time with all trial payments credited. One extension of six months can be had if the customer is unable to buy at the end of the first trial period. Under this plan the dealer gets $10 for signing a trial customer and $21 wiring fee if he is a wiring contractor in addition to a pro rata share of other installation work.

Prize-Lighting Contest Calls for New Methods

About 85 per cent of the designs proposed by architects in Beaux Arts-Illuminating Engineering Society prize contest call for special built-in units for future church lighting.

Further proof of the trend toward architectural lighting with co-ordination of light and architecture and using built-in unstandardized lighting units is shown by the recent results of the Beaux Arts-Illuminating Engineering Society prize contest. The views of the student architects indicate a change will be necessary in the lighting fixture industry as at present organized. Only three out of 209 designs submitted called for the pendant lighting fixtures found in manufacturers' catalogs, and even conventional types were in a minority with only 15 per cent of proposed fixtures easily made by the industry.

A survey of the renderings in the third annual prize contest, which called for the interior architectural and lighting design of an Episcopal Church, made by A. L. Powell, vice-president of the Illuminating Engineering Society, showed that one-third of the designs employed lighting units recessed above the ceiling. A number of these employed "pinhole" or "down-light" units. A trend to the adoption of directional church lighting with fixtures projecting the light toward the altar is shown with the congregation protected from glare. Almost universally, lighting fixtures were projected by louvers, or appropriate ornaments, with many students using decorative grilles to conceal lighting fixtures. Some projected light from statues, which consequently stand out in silhouette against brilliant backgrounds.

The 209 drawings show the following designs:

	Per Cent
Conventional pendant fixtures	3
Unconventional fixtures with built-in reflectors	10
Units hidden above ceiling	33
Indirect lighting from wall to wall	25
Direct lighting built into the structure	13

LETTERS TO THE EDITOR

Rectifier Anode Currents With Current Transformers

To the Editor of the ELECTRICAL WORLD:

In your issue of March 17, 1934, page 395, under the heading "Rectifier Anode Currents with Current Transformers," J. H. Cox of the Westinghouse Electric & Manufacturing Company describes a method for measuring the anode current of six-phase rectifiers by means of current transformer and ammeter. Equations are given by which the r.m.s. value of the anode current can be determined from a combined measurement of the currents of two opposed anodes.

As a further contribution to this subject, I would like to mention the use of current transformers connected as described by Mr. Cox for the purpose of measuring the arc loss in rectifiers with wattmeters. This method of loss measurement has been described in an A.I.E.E. paper, "New Trends in Mercury-Arc Rectifier Development, by Othmar K. Marti of Allis-Chalmers Manufacturing Company, which paper was presented at the Pacific Coast A.I.E.E. convention, Portland, Ore., in September, 1930.

It may also interest the readers of the ELECTRICAL WORLD to know that in 1931 two automatic rectifier substations were built by American Brown Boveri Company, Inc., each station containing an 850-kw., 625-volt rectifier of Brown-Boveri design as now manufactured by Allis-Chalmers Manufacturing Company. Due to the relatively high supply voltage to these stations (33,000 volts) the primary oil circuit breakers, as well as the customary primary instrument and metering transformers, have been entirely eliminated. For overload protection of these rectifiers suitable current transformers are used in the anode circuits for the operation of overload relays. The current transformers are connected into two opposing anode circuits in the manner described by Mr. Cox.

W. E. GUTZWILLER,
Sales Engineer.
Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

Tube Expansion Opened Annealing Circuit in 1926

To the Editor of the ELECTRICAL WORLD:

On page 376 of the March 10 issue I note the article on tube annealing by electricity. The heading states you wonder why this was not done before. The writer had charge of work of this kind in annealing condenser tubes at the Northern States Power Company in Minneapolis in 1926. The power used was the standby battery, of which we used only a few cells. The expansion of the tubes tripped an air circuit breaker.

JAMES E. WILKINS,
Instructor in Electrical Engineering.
University of Kentucky.

NEWS OF THE WEEK

T.V.A. Inaugurates Plan for Rural Electrification

What may be the key to Tennessee Valley Authority's rural electrification program has been set up in a plan of power distribution embracing Alcorn County, Mississippi, in which both city residents and farmers will be supplied electricity at the same rate. The county includes Corinth, a city of 6,000 population.

Distribution will be managed by the Alcorn County Electric Association, a non-profit organization. City and county governments will not be involved in either the purchase or management of the system. With distribution lines in Corinth and two rural extensions purchased from Commonwealth & Southern Corporation, T.V.A. is completing the rural system. Base rates for current will be the same as those now in force at Tupelo, Miss., plus a surcharge added to amortize the cost of the system. Upon completion of the purchase of the system from T.V.A. the surcharge will be removed.

First sale and demonstration of electric appliances manufactured for the Electric Home and Farm Authority will be held at Tupelo, Miss., early in May, according to David Lilienthal.

Informal application for Tennessee Valley Authority power has been made by the city of Memphis. It is expected that a referendum will be submitted to the voters within the near future for action on the possibility of a municipal utility system. The city is now served by the Memphis Power & Light Company.

Another New York Utility Inquiry?

Ten of Lehman's reform bills pass the state Senate. New utility-legislators letters lead toward state-wide investigation. Assembly action awaited.

ON THE heels of disclosure of additional correspondence between Associated Gas & Electric Company executives and several members of the New York Legislature at the Federal Trade Commission hearings, the state Senate late this week voted a broad state-wide inquiry of public utility corporations not only as to their supposed relationship with members of the Legislature, but also to include their service, operations, regulation by the Public Service Commission, operations in security markets, and their part, if any, in the election of public officials.

Earlier in the week the Senate had reconsidered and passed two of the key measures of the Lehman utility program, which it had defeated late last week, thus approving ten of the regulatory measures long fought for by the Governor. The two previously rejected bills, which with the other eight now are before the Assembly for action, would permit municipalities to acquire, construct and operate utility plants and would assess the cost of investigations against utilities. Although stiff opposition to the measures is expected in the Republican-controlled lower house, doubts have been expressed that more conservative leaders can hold the Assembly in check, after the press-made tornado stirred up by the latest Washington revelations. Action by that body, both on the bills and the investigation resolution, is expected next week.

No immunity for witnesses?

The unanimous action of the Senate in voting the utility investigation would give the investigators drastic powers in pursuing their inquiry. Committee witnesses could not refuse to answer questions on the grounds of possible incrimination, and the committee is permitted to turn over to the Attorney-General from time to time during its investigation any evidence received to show any acts of omission or commission by any person that would constitute a crime or violation of the law.

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Ferguson Debates Levitt

An offer to reduce rates by $774,000 a year if a certified public accountant could find overcharges in Hartford and New London within $100,000 a year of the claims made by Albert Levitt, United States Assistant Attorney-General, was the answer of Samuel Ferguson, chairman of the board of Connecticut Power Company, to the challenge of Mr. Levitt in a debate at New London, Conn., last week. Nearly 800 persons listened to the utility head and the crusader against utilities exchange replies to seventeen leading questions bearing upon local utility policies and management. Mr. Levitt charged the company's directors with interlocking connections with other large utility groups, assailed the area charge in residential rates and contended that the Hartford and New London utilities had overcharged the public nearly $8,000,000 above an 8 per cent return in the past five years. Mr. Ferguson denied "power trust" affiliations, introduced a spirited defense of the area charge and submitted figures certified by public accountants to show the allegation of excessive returns to be baseless.

Insull Return Scheduled

With the last chapter of his European flight apparently about to be written, Samuel Insull was scheduled to sail late this week in the custody of United States authorities aboard the steamer *Exilona,* leaving Smyrna for New York. Burton Y. Berry, third secretary of the United States Embassy, was selected to see Mr. Insull home.

Consolidated Gas Vote

More than 85 per cent of the employees of fifteen companies in its system having petitioned for an election on employee representation, George B. Cortelyou, president of Consolidated Gas Company, has announced that special elections will be held this week and next.

Bay State Body Rejects Fluctuating Rate Theory

In sharp contrast to current popular thought on rate regulation, the Massachusetts Public Utilities Commission rejected last week both the theory that utility charges should fluctuate with the state of general business and the idea that reasonableness of rates may be determined by the dividends paid on the stock. The decision of the commission dismissed petitions for reduction in rates charged for gas and electricity by the Lynn Gas & Electric Company.

"The notion that prices of services furnished by a public utility should rise and fall with prices of other commodities is unsound," the commission held in the present instance. There is no more reason, the commission stated, to expect rates to be reduced in times of depression than there is to expect like reduction in taxes. "There is less

reason," it said, "to expect reductions by the privately operated utility than by the publicly operated utility, as the privately operated utility must meet taxes from which the publicly operated utility is free.

"This company strikingly illustrates the fact that the per cent of dividends paid on the capital stock is often no criterion of their reasonableness . . . Viewed from the standpoint of the federal courts, it is not at all unlikely that the return of the Lynn company in 1932 would be found by a master to be not much more than 4 per cent on fair value of the property for rate-making purposes, notwithstanding it represented 24 per cent on the par value of its capital stock."

$295,000 savings over municipal plant

Going out of its way to emphasize the savings resulting to Lynn consumers from private utility operation, the commission estimated an annual saving to consumers over municipal operation of $295,000. In a comparative analysis of plant investment, interest charges, taxes paid and net earnings of the two methods of operation, the commission held that under municipal operation "the result to the public, assuming equal efficiency in operation and equal provision for depreciation, would have been a loss of approximately $295,000."

Range Buying Subsidized by Home Rate Rebate

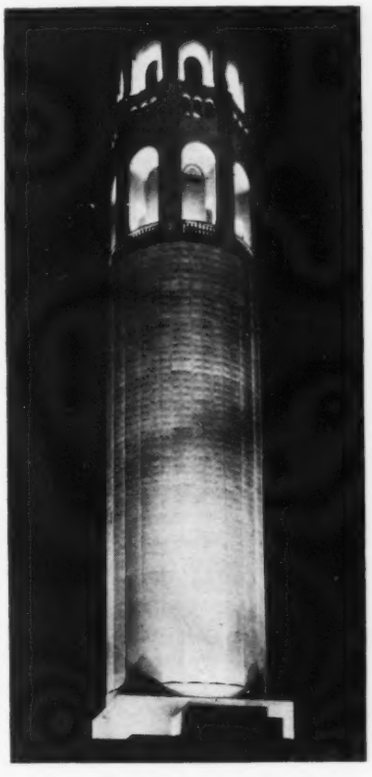
Seeking to encourage the installation of electric ranges and water heaters without capital investment by the residential customer, Central Massachusetts Electric Company will place in effect an eight-month trial rate of novel design on May 1 in the towns of Palmer and Monson. The rate provides that if the customer purchases from the utility either an electric range or a water heater or both there will be credited against the unpaid balance of the purchase price, including carrying charges, of such equipment, one-half of the amount by which each monthly payment by such customer for electric service exceeds the average monthly payment by him for electric service furnished during the twelve months preceding the installation of the range or the water heater.

Only such types of electric ranges not exceeding $130 in retail price and electric water heaters not exceeding $185 in retail price, and approved by the company, are to be accepted for this credit arrangement. If the credits in any twelve-month period do not aggregate $24 the deficiency must be paid at the end of the period. If the customer has not purchased electricity from the company for at least a year before entering into the credit rate usage the basis for determining the credits is assumed to be an average bill of $3 per month for such prior twelve-month period. The schedule contains an off-peak minimum water heating rate of 2 cents per kilowatt-hour and a 3-cent rate for energy in excess of 120 kw.-hr. per month.

Pennsylvania R. R. Orders Yard Engine Equipment

Inaugurating its locomotive construction program for the New York-Washington line, the Pennsylvania Railroad last week placed an order for more than $500,000 with Allis-Chalmers Company for electrical propulsion and control apparatus with which to equip fourteen switching engines. They will have three driving axles, no trucks and driving wheels of 62-in. diameter. Each engine will have three motors with an accelerating tractive effort of 50,000 lb.

31-KW. FLOODLIGHTING FOR COIT MONUMENT



Illumination of San Francisco's newest monument, the Coit Memorial Tower, combines the use of natural gas with 31,200 watts of floodlighting. The 175-ft. cylinder is lit from the base by twenty 1,000-watt floodlights with diminishing illumination. At the two arch levels eight 1,000-watt units with stippled lenses and sixteen 200-watt projectors throw the vaulted outlines in sharp relief. Eight additional 1,000-watt units atop the tower are directed vertically into the night, while above the top of the column a natural-gas torch sends up a 15-ft. flame.

Utility Fair Return Cut to 6% in Pennsylvania

With the avowed purpose of limiting public utility profits through rates reduced to fit the income of consumers, the Pennsylvania Public Service Commission announced this week that it would consider 6 per cent as a maximum fair return to the companies so long as the present economic conditions exist. For many years the commission has allowed 7 per cent as a fair return and has approved rates which would produce net earnings of 7 per cent on the value of the companies' properties.

Companies of high earning power which in 1933 earned more than 6 per cent profit will be called into conference with the commission in an effort to obtain voluntary rate cuts by the companies. If they refuse the commission has authority to start a rate suit against them of its own volition. Companies whose earnings during the depression years have failed to reach 6 per cent are to be exempt from requests to lower their rates to consumers. Officials of the commission described its action in seeking a sweeping downward revision of rates as the most "far reaching and significant step" ever taken by the Pennsylvania regulatory body.

Move seen as political

Political significance was read into the commission move by opponents of Governor Pinchot, who stated that the drive on utilities was timed to coincide with the opening of his campaign for Republican nomination as United States Senator.

Utilities Lend Support to Table Cookery Program

Active co-operation by leading public utilities in Edison Electric Institute's electric table cookery program (ELECTRICAL WORLD, March 24, page 457) is expressed in the first issue of *Table Cookery Topics*, published by the institute, which, with the National Electrical Manufacturers Association, is sponsoring the program.

With the aim of stimulating, through local promotional effort, the sale and use of household electrical devices which have proved practical and useful in the dining room and kitchen, the program, it is hoped, will result in encouraging all manufacturing and selling branches of the industry, as well as developing additional load for central stations.

Coming Meetings

Missouri Association of Public Utilities—Excelsior Springs, Mo., April 19-20, R. N. Beagle, 101 W. High St., Jefferson City, Mo.

Electrochemical Society — Asheville, N. C., April 26-28. Colin G. Fink, Columbia University, New York.

National Fire Protection Association—Atlantic City, N. J., May 14-18. A. R. Small, 109 Leonard St., New York.

American Institute of Electrical Engineers—Northeastern District meeting, Worcester, Mass., May 16-18. Summer convention, Hot Springs, Va., June 25-29. H. H. Henline, 33 W. 39th St., New York.

National Electrical Manufacturers Association—The Homestead, Hot Springs, Va,, May 21-24. A. W. Berresford, 155 East 44th St., New York.

Edison Electric Institute—Atlantic City, N. J., June 4-7. B. F. Weadock, 429 Lexington Ave., New York.

Canadian Electrical Association—Annual convention, Seigniory Club, P.Q. (Lucerne-in-Quebec). June 13-15, B. C. Fairchild, 409 Power Building, Montreal, Que.

American Society of Mechanical Engineers—Semi-annual meeting, Denver, Col., June 25-28. Calvin W. Rice, 29 W. 39th St., New York.

Federal Action Taken to Halt W. Va. Project

Following an overruling by the Federal Power Commission of its predecessor's consent to the withdrawal of the Electro-Metallurgical Company's declaration of intention to build the Hawks Nest project on the New River, West Virginia, the commission recently requested the Attorney-General to institute proceedings to enjoin construction and operation of the $7,000,000 power project. The work, now nearing completion, is within 10 miles of the head of navigation on the New Kanawha River and about 140 miles below the project of the Appalachian Electric Power Company, over which the commission successfully defended its jurisdiction in the New River case.

Received former secretary's approval

The New Kanawha Power Company, predecessor of the Electro-Metallurgical Company, in accordance with the power statute, filed a declaration of intention to construct the project in May, 1929. Following a report of the district engineer to the effect that interstate commerce would be affected, the company, it is alleged, on November 11, 1929, wrote a letter to the predecessor commission attempting to withdraw its declaration of intention, stating that it had decided to alter its plans for the project. The then executive secretary of the commission advised the company that the matter "would be regarded as closed on the records of the commission."

New Kanawha Power Company proceeded with the construction, and with the exception of notice to it that the commission held the executive secretary's action as invalid, no further action was taken until January 26, 1934, when the present commission, ruling that the former secretary had acted without authority, set the matter down for a hearing and made a finding that established federal jurisdiction. The company notified the commission that it refused to recognize its right to take such action, and the present request to the Attorney-General followed.

Labor, Exchange Bills Hit by Durable Goods Group

Fear that the Wagner labor bill and the securities exchange act would seriously and adversely affect the durable goods industries has resulted in a protest against the proposed legislation by the durable goods industries committee of the National Electrical Manufacturers Association.

In a letter addressed to code authorities and code committees in these industries the committee urges such prompt action in regard to the bills "as would insure that mature individual opinion, not perfunctory group action, be definitely expressed where it will carry the most weight." The enactment of the Wagner bill, the committee feels, would "interfere vitally with the scope of the National Industrial Recovery Act and would intensify labor unrest, resulting in confusion and controversy in the nation's industries. It would check recovery by making our shops and stores a battleground rather than orderly places of production and distribution."

Recommending rewriting of the securities exchange bill, the committee takes the stand that the durable goods industries, the source of the greater part of industrial unemployment, require financing largely from security sales, and that such sales cannot be made freely under the act. "If business needs capital for prosperity," the letter states, "it is in the public interest not to burden corporations issuing securities for the procurement of such capital or investors purchasing such securities with regulations so stringent as to discourage such transactions."

Lighting Trial Offered

In a drive for additional commercial and industrial load, Commonwealth Edison Company, Chicago, is presenting a trial offer to prospective purchasers of new lighting equipment. The utility offer consists of a ten-day free trial installation in which the newest type of equipment is placed in the prospect's establishment. If at the expiration of the trial period the results obtained from the new lighting system are satisfactory and the customer desires to have similar equipment permanently installed an estimate of the cost will be submitted. If it is decided not to change, the old fixtures will be put back in good working order at Commonwealth Edison expense.

A.S.T.M. Forms Committee for Insulating Materials

To consolidate the interests of electrical associations and societies in electrical insulation, a new sectional committee on electrical insulating materials has been formed by the American Society for Testing Materials, under the procedure of the American Standards Association. The scope of the committee will be "specifications and methods of test for electrical insulating materials."

Personnel of the committee includes representatives from various national bodies interested in this work, among whom are: R. W. Atkinson, General Cable Corporation; J. A. Scott, General Electric Company; M. F. Skinker, Brooklyn Edison Company; H. S. Vassar, Public Service Electric & Gas Company; Dean Harvey, Westinghouse Electric & Manufacturing Company, and F. S. Mapes, General Electric Company.

MERRY-GO-ROUND

Proponents of the communications commission bill were heard this week by the interstate and foreign commerce committee of the House of Representatives. The opponents will appear next week. It is understood that the opponents of the measure will state that they favor bringing together under one agency the functions now performed by the Interstate Commerce Commission, the Federal Radio Commission and other establishments, but they think the newly created commission should study the subject carefully and recommend legislation in February, 1935. Instead of attempting to formulate regulatory legislation such as is contained in the present bill, the opponents think the President's recommendation should be followed and the legislation worked out after more study has been given everything involved. There is evidence that the present bill was drafted by those familiar with Interstate Commerce Commission procedure as it applies to railroads, but who have little conception of practical operation of the radio, the telephone and the telegraph.

Majority and minority reports were filed with the House of Representatives April 10 by the judiciary committee of the House on the Johnson bill which proposes to limit the jurisdiction of the federal courts in the handling of utility cases.

PAUL WOOTON,
Washington Correspondent.

Nebraska Power Districts Fought in Supreme Court

Testing the constitutionality of the Nebraska law enabling the creation of public power and irrigation districts and empowering them to borrow funds from the federal government, action in *quo warranto* has been started in the state Supreme Court. A landowner under the Columbus power project began the action, which will determine the fate of the $15,000,000 projects now approved by Washington.

The action claims that the law does not give the right, power or capacity to the districts to acquire water rights; that it provides no means for regulating rates or for appeals from acts of boards of directors in fixing the same; that it invades private property rights and that it is conflicting and indefinite in that one section forbids sale or alienation of the plant or system except to borrow money from the federal government, and in another section it authorizes borrowing and issuance of warrants and debentures without limit.

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Alabama Spurs Farm Use

To stimulate rural use of electricity Alabama Power Company has recently concluded a series of twelve meetings in southern Alabama. A total attendance of 2,500 listened to suggestions for profitable uses of electricity on the farm.

New York Science Museum

A $3,000,000 P.W.A. loan will be sought for a Museum of Science and Industry for New York City, according to plans announced by Dr. Orestes H. Caldwell, one of the directors of the museum. Plans call for a total outlay of $8,000,000, of which $2,500,000 must be raised by popular subscription. This sum, together with a government loan, would qualify the museum for a bequest of the late Henry R. Towne, who left $2,500,000 for such a purpose provided enough funds were raised from other sources.

Ask Municipal Plant Tax

Demanding that the Los Angeles, Calif., Department of Water and Power be required to pay franchise and city taxes on the same basis as privately owned utilities, the City Council has submitted a resolution to this effect to Mayor Frank L. Shaw. The resolution asks a conference between the Council's water and power committee and a committee of councilmen to be named by the president of the council, and asks that the department be required to pay the city a 2 per cent franchise tax as well as a general property tax on the valuation of the department's properties. Based on estimated values of the department's properties within the city, and recent figures on departmental sales, an estimated tax return of more than $1,200,000 is indicated.

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Before we may have substantially lowered rates, it is my judgment that the present holding company system must be subjected to rigid and thorough federal supervision and regulation.

FRANK R. McNINCH,
Chairman Federal Power Commission.

Mr. McNinch, whose commission will make the recently ordered nation-wide rate census, held that a very substantial decrease in rates can be effected through increased consumption, in an address before a joint meeting of Charlotte, N. C., civic clubs.

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Wisconsin Power Protests

Disallowance of severance damage charges against a municipality purchasing only the local portion of a public utility, recently ordered by the Wisconsin Public Service Commission (ELECTRICAL WORLD, February 24, page 309), will be protested by Wisconsin Power & Light Company, according to the utility's president, Grover Neff.

Pigeon River Hydro Plant

Extraction of the potential power from the Pigeon River, international boundary stream, would yield 35,000 hp. at a cost of 4.8 mills per kilowatt-hour, as compared with the cost of steam generation in Duluth of 8.5 mills per kilowatt-hour, according to a recent report of Major A. K. B. Lyman, United States district engineer, which recommends an international project to develop the river. The power would be extracted by use of six dams, to take advantage of the 728-ft. drop in the river level in the area. The cost would be $4,304,800 and the annual charges $512,100. The expense and power of the project would be born equally by the United States and Canada. Direct permission for the development would be necessary, for under the Shipstead-Nolan bill flooding of government land must be sanctioned by Congress. The power would be marketed to mines and industries on the Minnesota ranges and the Canadian customers in the district.

Taxation, Regulation Mark Legislative Actions

Unabated activity in many state legislatures regarding public utility bills continued during the past week.

Elimination of service charges from utilities bills to consumers received impetus in two states. The Mississippi Legislature amended the bill prohibiting service charges by utilities by postponing for 30 days after passage its effective date. The Massachusetts Senate passed to the House its service charge bill under which service charges are eliminated, but the inclusion of an optional clause permits a different rate and service charge.

Virginia's Governor, George C. Peery, last week signed the bill enabling the state Corporation Commission to regulate security issues by public service companies.

With the statement that "its beneficial effects in Kentucky will depend entirely upon the manner of its administration," Governor Ruby Laffoon last week allowed to become law without his signature the bill creating a public service commission to regulate all utilities in the state (ELECTRICAL WORLD, March 17, page 417). "There would have been little opposition to the passage of this law," said the Governor, "had it excepted from its provisions municipally owned plants." The commission of three must be appointed within twenty days of the effective date of the act, June 13.

Ohio gross earnings tax increased

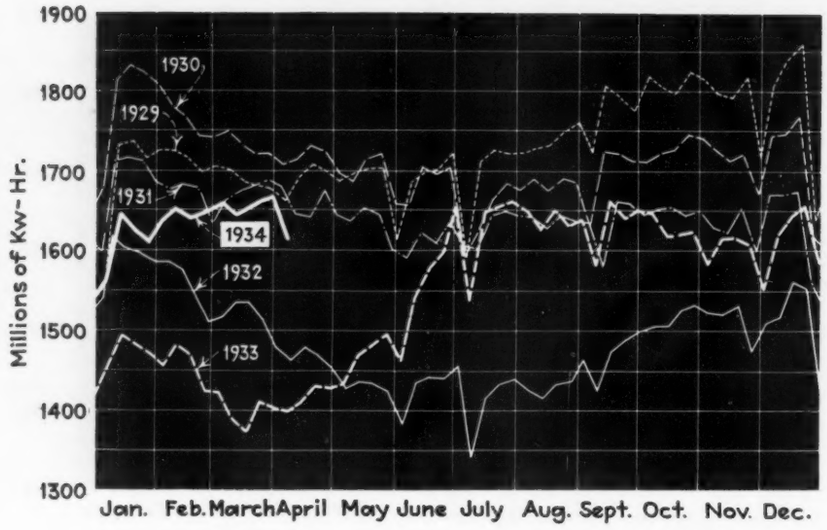
A bill to increase by 1 per cent the excise tax rate on gross earnings of utility companies having gross receipts of $100,000 a year or more passed the Ohio House last week by a vote of 86 to 9. The increase is expected to raise an additional $4,000,000 revenue to be devoted to public schools.

The Illinois Senate defeated a bill which would have exempted municipal plants from provisions of the 2 per cent sales tax. The state Department of Finance ruled recently that municipal lighting plants must pay the 2 per cent tax. It is probable that the question will be settled in the courts.

The South Carolina House has sent to the Senate the Santee-Cooper bill, an enabling measure to permit a state authority to borrow $34,000,000 from P.W.A. to develop the navigation and power plan as a state project.

Rhode Island's finance commissioner, F. S. Peck, has returned to the state Assembly with his disapproval a proposed act which would tax public utilities 1 per cent on gross earnings.

Output at Late January Level



During the week ended April 7 central stations for light and power generated 1,616,945,000 kw.-hr., or 3 per cent less than in the preceding week, the Edison Electric Institute announces. Although this marks a recession from the rate of activity during the past two months there remains a gain over the corresponding week in 1933 of 15.5 per cent and of 10.3 per cent over 1932. Compared with 1929 the present output shows a decrease of 2.8 per cent.

That the abnormal upward trend in progress since the latter part of January could continue indefinitely was scarcely to be expected. Despite the break, 1934 remains unique in having output in the first week of April larger than in the last week of January.

Changes were most pronounced in the industrial regions, especially the Central and Middle Atlantic, perhaps partly due, in the former, to the ending of accelerated activity in the automobile industry while interruptions were threatened.

Weekly Output, Millions of Kw.-Hr.

1934	1933	1932
Apr. 7...1,617	Apr. 8...1,399	Apr. 9...1,465
Mar. 31...1,666	Apr. 1...1,402	Apr 2...1,480
Mar. 24...1,658	Mar. 25...1,410	Mar. 26...1,515
Mar. 17...1,650	Mar. 18...1,375	Mar. 19...1,538
Mar. 10...1,647	Mar. 11...1,391	Mar. 12...1,538

Per Cent Change from Previous Year

Region	Week ended Apr. 7	Mar. 31	Mar. 24
New England	+16.0	+17.3	+19.2
Middle Atlantic	+10.5	+14.4	+12.7
Central Industrial	+21.3	+27.4	+27.0
West Central	+11.0	+10.5	+11.3
Southern States	+14.3	+17.2	+12.1
Rocky Mountain	+20.8	+22.1	+18.4
Pacific Coast	+12.9	+12.7	+12.3
United States	+15.5	+18.8	+17.6

Energy Revenue Lags as February Sales Rise

Although energy sales in February to ultimate consumers were 14.7 per cent greater this year than last, the corresponding revenue increased only 3.4 per cent to $154,831,700, according to the Edison Electric Institute. The latter figure should not be compared with the total revenue as published a year ago in ELECTRICAL WORLD, for it does not take account of intercompany sales, as did the previous figures.

Energy sold at wholesale for commercial light and power increased 26 per cent; retail-commercial gained 4 per cent. Domestic sales were 4.6 per cent more than in February, 1933, and nearly set the record for the month, missing the corresponding sales in 1932 by a narrow margin.

For the twelve-month period ending with February the energy sales to ultimate consumers were 7 per cent greater than in the preceding like period, but the revenue was off 1.3 per cent for the year.

Burlington Speed Train

Similar in design and appointments to the Union Pacific Diesel-electric streamlined train (ELECTRICAL WORLD, February 17, 1934, page 271), a lightweight train, the *Zephyr*, is being completed by the Edward G. Budd Manufacturing Company at Philadelphia for the Chicago, Burlington & Quincy railroad. The train has three-car units, seating a total of 72 passengers, and is built of stainless steel, electrically welded; it is completely air conditioned and lighted indirectly from overhead tubular ducts. All passenger compartments are equipped for radio reception. Electric driving equipment as well as other electrical appurtenances were built by the General Electric Company. Following delivery this month, it will be exhibited from coast to coast and later at the Century of Progress this summer. After the exposition it will be placed in regular service, on the Chicago, Burlington & Quincy, between Kansas City, Omaha and Lincoln, Neb.

Refrigeration Energy Use 20% of 1933 Total

Refrigerators show the way to all other appliances in estimated energy consumption during 1933, according to a table, reproduced below, and condensed from one prepared by the Edison Electric Institute. Ranges are second in kilowatt-hour consumption, with flatirons and water heaters closely grouped in third and fourth place.

The table below supplements the chart prepared by the E.E.I., which appeared in ELECTRICAL WORLD, March 31, page 494. The number of appliances in use was obtained in each case by taking the average of those in use at the beginning and at the end of the year, largely as given by *Electrical Merchandising*, which are based on the summation of annual production of appliances less an estimated replacement demand and application of factors to allow for duplicates and unused appliances, houses unoccupied, vacation periods, and other causes of non-use or curtailed use. If these factors were not used and the kilowatt-hours usually claimed for lighting were added the grand total would be twice the actual sales of domestic electrical energy in 1933, as recorded by the Edison Electric Institute.

Multiplying by the estimated energy taken by each appliance if in constant and regular use throughout the year gives the totals in the last column. An effort to incorporate figures on air-conditioning appliances failed because of a lack of reliable information on the subject.

Energy Used by Appliances

(An estimate for the Year, 1933)
(Edison Electric Institute)

Appliances	Total Number in Active Service	Annual Kw.-Hr. Use	Total Kw.-Hr. Used in 1933
Flatirons	13,470,000	50	673,500,000
Vacuum cleaners	6,545,000	36	235,600,000
Radio sets (socket only)	10,000,000	85	850,000,000
Washing machines	5,460,000	24	131,000,000
Toasters	3,040,000	50	152,000,000
Percolators	2,120,000	50	106,000,000
Space heaters	1,200,000	40	48,000,000
Refrigerators	4,075,000	575	2,343,000,000
Ranges	1,000,000	1,750	1,750,000,000
Oil burners	705,000	240	169,200,000
Ironing machines	603,000	125	75,400,000
Water heaters	201,000	3,000	603,000,000
Electric clocks	6,300,000	18	113,400,000
Total, above appliances	.....	....	7,250,100,000
Small appliances & lighting	19,800,000	238	4,710,156,000
Total, all domestic sales	.....	.....	11,960,256,000

As to Rates——

• Virginia Electric & Power Company's request for increases in electric rates is being fought by the city of Norfolk in a protest fiied with the state Corporation Commission.

• Utah Power & Light Company has been ordered by the state Public Utilities Commission to make a valuation and appraisal of all its assets used in furnishing electrical service. The order is issued in connection with the general rate case instituted by the commission.

• Louisville Gas & Electric Company will lower electric rates for approximately 600 consumers by changing certain classes of consumers from commercial users to residential users, including professional men using one room of their residence for an office, boarding or rooming houses of twelve rooms or less and duplex residences and other apartments.

• Indiana Public Service Commission has ordered the accounting departments of all public utilities to check 1933 sworn statements to make sure no details or information have been omitted. The commission in recent rate hearings has alleged that utilities have been submitting inaccurate information in annual reports required by Indiana law. The loose information, the commission declares, handicaps testimony and investigation when utility patrons appeal for rate reductions.

• Central Illinois Public Service Company has recently put into effect a water heating rate of 1 cent per kilowatt-hour good during off-peak periods. This rate is available only to customers having electric ranges.

• Staten Island Edison Corporation electric rates will be reduced 5 per cent, representing an annual saving of $120,000 to the consumers of Richmond County. The new rates will be effective as of October 25, 1933, and the company will refund to customers the difference between the amounts billed and the amounts that would have been charged under the new rates. The rates have been accepted for an indefinite period and the new schedule closes the proceeding in which the commission started to fix temporary emergency rates for one year. It is estimated that the reductions will save residential consumers $41,000 a year and commercial customers about $35,000. Reductions in primary rates will save an additional $3,000 annually for the consumers. Other reductions to be announced will make the total saving $120,000.

• Georgia Power Company has reduced its water heating rates, effective with meter readings on and after April 1, with the result that for the first time in the history of Georgia residential customers may obtain electric service for less than 1 cent per kilowatt-hour. Under the new "off-peak" water heating rate the $1 per month service charge is eliminated and all current used is billed at only 8 mills per kilowatt-hour. The minimum charge remains $1 per month. Formerly this rate was $1 per month service charge, plus 1 cent for each kilowatt-hour used.

• Alabama Public Service Commission has ordered the Alabama Power Company to reduce its commercial rates approximately $101,000 annually. This reduction, added to those previously ordered in residential, rural and cotton gin rates, makes a total estimated annual reduction of $553,000 in the revenue of the company ordered since August 1, 1933.

• Indianapolis Power & Light Company has filed with the state Public Service Commission a new optional cooking and heating electric rate. Customers buying electric ranges of 2,500-watt capacity and buying a new type water heater of thermostatic design will be eligible to a rate having a $2.50 a month minimum. Those willing to use the service during the off-peak period from 10.30 p.m. until 6.30 a.m. would pay a $5 monthly minimum charge and would use energy at the rate of 2 cents a kilowatt-hour for the first fifty and one cent for all over that amount. The new rates, being optional, have no effect on the present general rate investigation being conducted by the commission against the company.

• Iowa Electric Light & Power Company's voluntary reduction in electric rates has been accepted by the City Council of Boone, Iowa, domestic rates being cut from 7.5 to 7.2 cents per kilowatt-hour, reductions along the line and for various types of service ranging from 4 to 22 per cent.

Wide cuts in Missouri

• Missouri General Utilities Company has been ordered to file a new schedule of rates by May 15 with the state Public Service Commission for eighteen towns served by it. In its order the commission pared $482,205 from the investment cost as listed by the books of the company for rate-making purposes and fixed the valuation of the utility at $697,500 as fair. The reduction to electrical users in the towns affected will be approximately $14,000 annually, or 5 per cent. The commission also reduced the Missouri Southern Public Service Company's rate-base valuation from $156,000 to $95,000. However, there will be no reduction in rates. In passing on the two cases the commission criticised the holding company set-up under which managerial advisory, engineering and other service fees are charged against the two operating companies by seven affiliated companies controlled by the Associated Gas & Electric Company of New York. The commission criticised the Missouri General Utilities for excessive prices paid for some of its properties and for write-ups of values. "If the utilities desire to pay prices for operating utility properties far in excess of their real values, as is the case here, they must bear the consequences," the commission continued. "They will not be permitted to charge rates to the consuming public designed to yield a return upon such excessive prices."

• New York State Electric & Gas Corporation's reduction in electric rates for the city of Plattsburg have been approved by the state Public Service Commission. The new rates will save consumers approximately $15,000 a year, of which $10,000 will be saved by the residential customers and $5,000 by commercial consumers.

Municipal Items

URBANA, ILL.—By a vote of 2,204 to 1,811 voters have rejected a proposal that the city construct, maintain and operate a municipal light and power plant and distribution system to cost approximately $650,000.

COLUMBIA, MO.—City Council voted unanimously to drop the suit instituted in the state courts testing the validity of assessing the state sales tax against electric light and power sold by the city's municipal plant (ELECTRICAL WORLD, April 7, page 526).

LODI, CALIF.—City Council has set April 23 for a special election on a $580,000 bond issue to finance the erection of a hydro-electric plant. In a statement regarding details for the plant and dam on the Mokelumne River, from which power can be brought to the city at a cost of approximately 4 mills per kilowatt-hour, the Council pointed out that the building of the plant depends upon securing a federal loan and grant.

BELOIT, WIS.—City was denied authority to build an electric plant to provide power for lighting its streets and public buildings by the state Supreme Court in a ruling made last week without first obtaining a certificate of public convenience and necessity from the Public Service Commission. The decision was made in the case of the Wisconsin Power & Light Company against the city. The company furnished service under contract until about two years ago, when there was a disagreement over the price to be paid on a future contract. Since that time the private utility has been giving service on the basis of the old contract.

FINANCIAL · · · BUSINESS

$19,000,000 Power Issues Filed With Trade Board

With combined securities issues amounting to $18,946,100, three companies handling power, two of them Canadian, have filed their proposed flotations for registration under the securities act with the Federal Trade Commission.

Central States Power & Light Corporation proposes to issue $6,000,000 of 5 per cent unsecured debentures, the proceeds to be issued in exchange for the surrender for cancellation by Utilities Power & Light Corporation of a demand note on which there is a balance owing of $5,957,120.68. The cash balance of the proceeds will be used for working capital and other corporate purposes. It is contemplated that $1,400,000 in principal amount of the debentures will subsequently be offered by Utilities Power & Light Corporation through Central States Utilities Corporation to the holders of ten-year 6 per cent secured gold bonds of Central States Utilities Corporation in exchange for these gold bonds on the basis of 40 per cent in principal amount of debentures for 100 per cent in principal amount of the secured gold bonds.

Of the two proposed Canadian flotations Dominion Gas & Electric Company plans to issue $1,884,500 in collateral trust gold bonds, 6½ per cent series, with common stock warrants attached. Proceeds will not revert to the company, as the bonds are already outstanding. Bowater's Canadian Paper Corporation, a reorganized group having electric and water-power operations in addition to its paper production, plans issue of $11,061,600 first mortgage bonds in a reorganization plan contemplating acquisition of Price Brothers & Company, Ltd., Quebec.

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Central West Wins Suit

Dismissal of bankruptcy action brought against the Central West Public Service Company by certain minor stockholders was ordered this week by the United States Circuit Court of Appeals, which directed Charles F. McLaughlin of Omaha, the federal court receiver, to return all properties to the company. The decision of the court maintained that the officers had been successful in the management of the company and that there was no proof to substantiate the plaintiffs' charges that funds of the company had been diverted.

East Coast Reorganized

Consummation of the plan for reorganization of the East Coast Utilities Company is nearly effected, the protective committee for holders of the company's first mortgage bonds and secured notes indicated this week, in announcing that new securities are ready for delivery. More than 98 per cent of the notes and 96 per cent of the bonds participated in the plan. The new company is the East Coast Public Service Company and owns all miscellaneous assets of the former company and the collateral securing its notes and bonds (ELECTRICAL WORLD, February 17, page 277).

Michigan P. S. Dividend

Resuming dividend payments on its preferred stock after a lapse of more than a year, Michigan Public Service Company this week declared 87½ cents a share on the 7 per cent and 75 cents on the 6 per cent preferred, payable on May 1 to stockholders of record April 14. Last payment was made January 2, 1933.

National G. & E. Deposits

Although securities representing more than 77 per cent of the indebtedness of National Gas & Electric Corporation have been deposited with the reorganization committee (ELECTRICAL WORLD, November 11, page 615), the committee has sent out a request for additional deposits before declaring its plan operative. The committee now has on deposit 73 per cent of the outstanding first mortgage collateral 5½ per cent bonds, 71 per cent of the 5½ per cent convertible notes, 100 per cent of the intercompany bonds and 62 per cent of the preferred stock.

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Westinghouse Orders Up 57% for First Quarter

For the first quarter of 1934 orders booked by his company were 57 per cent greater than in the same period last year and totaled $20,100,000, Frank A. Merrick, president, told shareholders at the annual meeting of stockholders of the Westinghouse Electric & Manufacturing Company late this week. "The outlook for the months immediately ahead is encouraging and our business trend seems to be again definitely upward," Mr. Merrick stated. "If these improved conditions continue our company will benefit materially from the operating economies that were put into effect during the past year."

Two new directors were elected at the meeting—A. L. Humphrey, chairman of the board of Westinghouse Air Brake Company, and H. S. Wherrett, president Pittsburgh Plate Glass Company.

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Stay Wire and Cable Rule

With the statement that "justice requires that a stay of such order be made," the National Recovery Administration announced this week that General Johnson has granted a permanent stay of his order permitting limited exemption for the wire and cable division of the electrical industry, from Articles IX and X of the electrical manufacturing industry code (ELECTRICAL WORLD, April 7, page 527). Protest from the National Electrical Manufacturers Association, which predicted "inevitably disastrous results," caused the order to be stayed, the NRA announcement stated.

Anaconda Wire Cuts Loss

Net loss of the Anaconda Wire & Cable Company for the year 1933 after taxes, depreciation and other charges was reduced to $213,872, compared with loss of $1,045,110 in 1932 after taxes, depreciation and other charges. Current assets on December 31, 1933, including $237,088 cash, amounted to $5,775,071, and current liabilities were $1,672,758, against cash of $252,642, current assets of $5,233,611 and current liabilities of $1,689,629 the year before.

SPRING PEAK?

Two questions dominate the business picture. One is, whether or not the recession in activity now becoming manifest represents the passing of the traditional spring peak. The other is, whether or not the spring peak, if any, will be exceeded in the immediate future. To phrase it otherwise, current volume indexes are off somewhat from preceding weeks, energy output 3 per cent, carloadings fractionally, bituminous coal production quite appreciably, but steel activity little changed. General indexes show some recession.

Security markets continue rise in presumable anticipation of better times. Department of Commerce reports February factory wages and employment as the highest since 1931. Business, through readjustments in NRA, is more on its own than it has been for more than a year. Government spending continues, with plans for a prolongation of the spree into 1935 with $1,500,000,000 for public works alone.

It would appear that the forces leading to expansion far outbalance mere seasonal fluctuations and strike threats. Congressional adjournment seems likely by June 1.

Jersey Public Service Reports 1933 Expansion

More electric refrigerators were sold by Public Service Corporation of New Jersey in 1933 than in any other year in its history, according to the corporation's annual report. Refrigerator sales totaled 4,030, up 35 per cent from 1932.

Meters in service at the end of the year numbered 932,908, an increase of 8,865. This compares with a decrease of 3,858 for 1932 under 1931.

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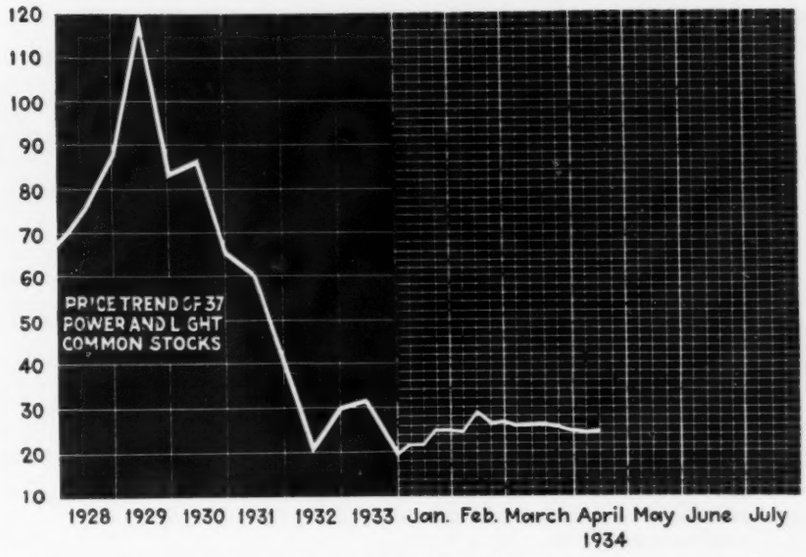
Redemption Policy Stated

Bona fide foreign holders of American Water Works & Electric Company bonds maturing April 1 were paid at the old gold ratio specified on the face of the bonds, while residents or citizens of the United States received current dollars for their bonds, the company has advised the committee on stock list of the New York Stock Exchange. Foreign holders were asked to certify that they are not residents or citizens of the United States in presenting their bonds or coupons for payment.

Beauharnois Bonds Sold

Heavy oversubscription of the first large corporate flotation in Canada since 1931, in the form of $15,000,000 Beauharnois Light, Heat & Power Company first mortgage sinking fund bonds, was announced last week by Dominion Securities Corporation, Ltd., manager of the syndicate handling the issue. The bonds, bearing interest at 5½ per cent and offered at 95.50 and accrued interest to yield 5.79 per cent, do not represent new financing on the part of Beauharnois Power Corporation, the parent company, but are part of bonds received by banks last year under the terms of reorganization in satisfaction of bank advances.

Utility Stocks Little Changed



Though settlement of immediate labor difficulties in Detroit was a stabilizing influence on the market this week, price changes in utility shares were insignificant. "Electrical World" index, 25.2; last week 25.3.

Utility to Refund Losses

Repayment of the entire purchase price of all American Consolidated Power Corporation preferred stock will be made to Lowell, Mass., stockholders who suffered losses in the issue, by Lowell Gas Light Corporation, through whose office the stock was sold, the lighting company has announced. The utility stated that although under no legal obligation to do so, it will repay the entire purchase price of all shares in twenty annual installments of 5 per cent each.

Chicago Sets a Record

Seven million electrical operations, performed by 400 men over a period of one year without a single major error, is the remarkable record of efficiency recently established by substation operators of the Commonwealth Edison Company, Chicago, states the *Edison Round Table*. In this period, ended March 19, each operator had 17,000 opportunities to make a misstep which might have caused an interruption of service to customers or serious damage to equipment. The present operating force averages eleven years of service and veteran operators average only one major error in about 25 years of service.

Current Earnings Reports of Electric Light and Power Companies

Operating Companies

	1934	1933	Per Cent Increase	Operating Ratio 1934	Operating Ratio 1933
Alabama Power					
(Year ended February 28)					
Gross earnings	$15,588,505	$15,336,295	— 1.6	49	48
Net earnings	7,889,012	8,011,614	— 1.5		
Net balance	847,085	1,040,519	— 18.5		
Consumers Power					
(Year ended February 28)					
Gross earnings	26,102,561	27,216,458	— 4.1	55	52
Net earnings	11,623,694	12,888,433	— 9.9		
Net balance	2,898,301	4,188,991	— 30.9		
Georgia Power					
(Year ended February 28)					
Gross earnings	22,194,472	22,081,068	0.5	50	48
Net earnings	10,994,896	11,350,123	— 3.1		
Net balance	1,925,824	2,195,584	— 12.3		
Kansas City Power & Light					
(Year ended February 28)					
Gross earnings	14,286,928	14,717,047	— 3.9	60	57
Net earnings	5,677,607	6,348,332	— 10.6		
Net balance*	3,218,908	3,842,256	— 16.2		
Ohio Edison					
(Year ended February 28)					
Gross earnings	14,962,275	15,122,190	— 1.0	50	48
Net earnings	7,437,033	7,824,222	— 4.9		
Net balance	1,670,971	2,161,657	— 22.6		
Tennessee Electric Power					
(Year ended February 28)					
Gross earnings	$11,556,226	$11,466,035	0.8	60	58
Net earnings	4,589,199	4,857,336	— 5.5		
Net balance	384,996	651,336	— 40.8		

Holding Companies

	1934	1933	Per Cent Increase	Operating Ratio 1934	Operating Ratio 1933
Commonwealth & Southern and subsidiaries					
(Year ended February 28)					
Gross earnings	$109,901,468	$111,921,331	— 1.8	56	54
Net balance	417,654†	2,480,201	—116.0		
Engineers Public Service and constituent cos.					
(Year ended January 31)					
Gross earnings	42,361,212	45,706,267	— 7.3	67	63
Net balance	1,106,772†	1,692,242	—165.0		

*Applicable to all dividends. †Deficit.

Gross earnings—(Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings—Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Net balance—Balance available from income for common stock dividends.

in 1934 Appliance Sales G. E. Forecasts Gain

"Unmistakable" signs of increases in the sales of electric appliances for the home are forecast by the General Electric Company, whose appliance sales last year were 78 per cent better than in 1932. Estimated 1934 appliance sales as compared with 1933 and 1932 are as follows:

	1934	1933	1932
Radios.....	$3,950,000	$3,806,000	$2,620,000
Home laundry.....	1,060,000	962,132	572,060
Ironers.....	85,000	65,000	50,000
Cleaners....	635,000	547,536	447,056

Estimated value of 1934 retail appliance sales for the entire industry, as compared with 1933 and 1932, is as follows:

	1934	1933	1932
Radios.....	$183,000,000	$146,000,000	$141,000,000
Home laundry.....	64,000,000	53,450,000	37,000,000
Ironers.....	6,000,000	4,550,000	3,500,000
Cleaners....	31,800,000	26,000,000	20,100,000

"Signs are unmistakable that business will constantly improve for the next six months," the company says. "The year 1934 offers us the biggest potential market for appliances since 1929. We have placed manufacturing orders for well over 100,000 vacuum cleaners, washing machines and radio sets for immediate delivery."

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Hurley Company Expands

Substantial expansion of the washer and ironer manufacturing facilities of the Hurley Machine Company is planned with the purchase of the Meadows Manufacturing Company's buildings and equipment in Bloomington, Ill., according to Edward N. Hurley, Jr. Meadows trade names will be retained and some of the washers manufactured by Hurley for the General Electric Company also may be produced in Bloomington, Mr. Hurley stated.

British Electrical Pay Up

Restoration of wage cuts to the 1929 level has been proposed by the British electrical supply industry to be effective May 1, according to a plan submitted to the National Joint Council for the industry in reply to a claim made by unions for wage increases in several areas. The new rates will be effective for a one-year period.

N.E.M.A. Urges Filing Definitions of Scope

Urging a rapid completion to the filing of definitions of scope of products manufactured by the electrical industry, the National Electrical Manufacturers Association has appointed J. J. Gibbons to act in co-operation with the chairmen of all N.E.M.A. sections, groups and subgroups in order to get the definitions established and on record.

A form on which all items of the industry have been segregated according to the sections and groups to which it is thought they properly belong has been sent to the chairmen. Conflicting claims will have to be compromised, according to N.E.M.A., and to this end a products scope committee has been appointed to pass on all questions of conflict.

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Kelvinator Orders Rise

With March shipments totaling 30,009 units, Kelvinator Corporation's total shipments for the first six months of its present fiscal year are 79 per cent ahead of the best previous first half in its history and more than 100 per cent over the same period last year, Vice-President H. W. Burritt reported last week. Total shipments for the six-month period beginning October 1, 1933, were 75,885, compared with 37,084 for last year and 42,383 units shipped in the six months between October 1, 1930, and March 31, 1931, the previous best first half.

French Ease Import Quota

Substantial increase in the second quarter quota for American electric motors, generators, industrial transformers and current rectifiers have been announced in the French *Journal Officiel* for April 1. Imports for the next three months have been fixed at 114.2 metric tons, as against 6.7 metric tons for the first quarter (reduced by previous shipments from a basic quota of about 55 metric tons per quarter).

Promote Air Conditioning

Anticipated markets for air-conditioning equipment and increased load have resulted in the formation of groups to promote the sale of this equipment in two cities recently. The Air Conditioning Council of Kansas City has been announced with the publication of *Air Conditioner*, a tabloid promotional organ. Birmingham, Ala., now has its Air Conditioning Bureau, which has begun an educational campaign among industrial and commercial establishments in the city. Membership in both groups is made up of utilities, manufacturers and distributors of air-conditioning equipment, builders, contractors, etc., located in the Kansas City and Birmingham districts.

Major New Construction This Week

Fort Madison Electric Company, Fort Madison, Iowa, plans new transmission line. Application made for permission.

Motors and controls, conveyors, electric hoists, loaders, etc., will be installed in two additions to plants of Bernheim Distilling Company, Louisville, Ky. A $1,000,000 project.

Until April 25, Bureau of Yards and Docks, Navy Department, Washington, D. C., asks bids for electrical distribution system at local Naval Observatory, including wire and cable, ducts, etc. (Specification 7616.)

Ohio River Power Company, Canton, Ohio, plans new transmission lines over Muskingum River. Application made for federal permission.

Frankenmuth Brewing Company, Frankenmuth, Mich., plans new plant. Cost about $100,000.

Motors and controls, regulators, conveyors, etc., will be installed in new plant unit of Flat Glass Specialty Company, Clarksburg, W. Va. Cost about $100,000.

Until April 19, United States Engineer Office, Missouri River Division, Kansas City, Mo., asks bids for electrical substation buildings at Fort Peck dam site, Missouri River, near Glasgow, Mont. (Circular 71.)

University of Washington, Pullman, soon takes bids for central power plant. Fund of $225,000 arranged.

Milford, Iowa, soon takes bids for equipment for city-owned light and power plant. Fund of $70,000 available.

Clinton Distilleries Corporation, Clinton, Mass., plans purchase of equipment for new plant. Company has arranged stock issue of $1,786,000, portion of fund to be used for purpose noted.

Woodward, Okla., is concluding financing for $200,000 for new city-owned light and power plant.

Hall's Distillery, Green Bay, Wis., plans extensions and improvements, with installation of new equipment. Cost over $150,000.

G. E. Orders Up 50%

An increase of 50 per cent in orders received by General Electric Company during the first quarter of 1934 compared with the same 1933 period was announced this week by President Gerard Swope. Orders received totaled $38,148,654, contrasting with $25,511,644 for the first quarter of 1933.

New York Metal Prices

	Apr. 3, 1934 Cents per Pound	Apr. 11, 1934 Cents per Pound
Copper, electrolytic....	8.00	8.375
Lead, Am. S. & R. price	4.00	4.25
Antimony.....	7.625	7.95
Nickel ingot.....	35.00	35.00
Zinc, spot.....	4.65	4.75
Tin, Straits.....	55.625	56.35
Aluminum, 99 per cent.	23.30	23.30

MEN OF THE INDUSTRY

James M. Barry, President of New Southeastern Group

James M. Barry, who was elected president of the Southeastern Electric Exchange at its first conference recently held in Savannah (ELECTRICAL WORLD, April 7, page 524), is an authority on utility problems in the Southeast and has been in the heart of the Muscle Shoals territory for many years.

He became vice-president and general manager of the Alabama Power Company about two years ago after an association that dates back to 1918. In that year he came East from the Pacific Coast to join the Alabama utility as eastern division manager in Anniston.

In 1921 he was appointed assistant chief engineer, five years later manager of the southern division, with headquarters at Montgomery, subsequently returning to Birmingham as manager of retail operations. The intimate knowledge he had obtained of the company's operations through service in its various districts made him the natural choice for the office of vice-president in charge of operation, to which he was elected in 1927. He assumed the title of vice-president and general manager in 1932.

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GEORGE D. MUNGER has been placed in charge of development of domestic electric consumption in the Tennessee Valley area for the Electric Home and Farm Authority. Mr. Munger, who has been associated with the Central Hudson Gas & Electric Company at Poughkeepsie for the past ten years, brings to his new position a broad knowledge of the domestic electric field. During the past five years he has been in charge of developing and executing a general program of domestic electrification in the area served by the Central Hudson company, an area extending from Albany to Peekskill, N. Y. In 1931 Mr. Munger was made the recipient of the McGraw Award in recognition of his success in co-ordinating the activities and policies of the appliance dealers of the Central Hudson territory for the promotion of the domestic market.

ERICH A. MEES, well-known consulting engineer and member of Mees & Mees, of Charlotte, N. C., has been appointed director of the water resources division of the national power survey just organized by the Federal Power Commission under orders of President Roosevelt (ELECTRICAL WORLD, August 26, page 259). For the past seventeen years Mr. Mees has been engaged in general engineering work.

J. R. Kearney, Jr., Named Senior Vice-President

Directors of the James R. Kearney Corporation have recently announced the election of James R. Kearney, Jr., as senior vice-president. Starting as advertising manager when the company was organized in 1926, Mr. Kearney subsequently undertook broader duties and enlarged his responsibilities to include the management of the St. Louis office. His resourcefulness in keeping the company abreast of the rapid changes in the electrical industry soon led to his promotion to the office of vice-president and assistant general

manager with supervision over the entire St. Louis headquarters.

Mr. Kearney was graduated from Missouri University with the degrees of bachelor of journalism and master of arts. He is third vice-president of the National Industrial Advertisers' Association, a past-president of the St. Louis Industrial Marketing Conference and a member of the Electrical Board of Trade.

FRANCIS JEHL, formerly assistant to Thomas A. Edison, was made a Chevalier of the Legion of Honor by the French government, the order having been bestowed last week by M. Morand, French Consul, at a banquet in Detroit, where Mr. Jehl is now curator of the Edison Museum. Mr. Jehl was prominently identified with the early developments in the electrical art in Europe and America.

OBITUARY

Dr. Oskar von Miller

Dr. Oskar von Miller, one of Europe's foremost industrial engineers and founder of the famous Deutsches Museum in Munich, died in that city April 9, at the age of 78. A pioneer in electrical power engineering in Germany, Dr. von Miller championed the cause of alternating current, resigning as a director of the German Edison Company to conduct experiments in this field. His success in transmitting electricity over short lines in Germany resulted in his building the first long-distance high-tension transmission line ever constructed, extending from Lauffen to Frankfurt-am-Main, a distance of 108 miles, operated at 15,000 volts, three phase, 40 cycles and completed in 1891. In the years that followed he planned electric power systems for Nuremberg, Kassel and other large German cities. He was also engineer for the nation's early water-power projects and in recent years had formulated a unified electric power plan for the entire Reich.

Dr. von Miller devoted the last 30 years of his life to the Deutsches Museum, a project which under his direction developed into the world's greatest museum of natural science and technology. It was started in 1909, but war and post-war conditions delayed its completion until 1925. Popularizing science, industry and engineering, this museum has been copied in many parts of the world.

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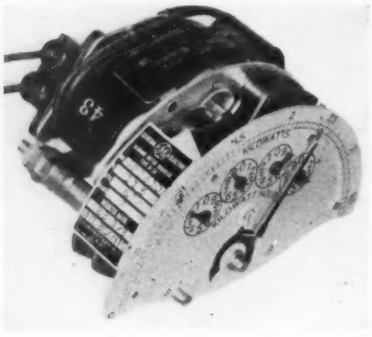
HARRY G. KESSLER, controller of the Commonwealth & Southern Corporation, died April 7 at his home in Brooklyn, N. Y., after an illness of a few hours. He was 51 years old. Mr. Kessler's entire business career was devoted to public utility accounting. He served as controller for the Commonwealth Power, Railway & Light Company, New York; director and controller of the Consumers Power Company and the Commonwealth & Southern Corporation of New York and controller of the Tennessee Electric Power Company, Ohio Edison Company and various other utility companies.

NEW EQUIPMENT

Demand Meter Registers

For application on eight G-E watt-hour meters the type M-20 demand meter register in which need for service has been minimized has been announced by the General Electric Company, Schenectady. A high-torque "Telechron" timing motor permits the use of high



torques and safety factors throughout the design. Motor barrel can be refilled with oil and motor can be easily removed for service or replacement. A testing device permits over-all accuracy check of the register in about a minute and is manually operated. Follow-up reset principle is used and full torque is available automatically to insure positive reset. Need of adjustments has been minimized and those necessary can easily be done. Bearings are permanently located and all materials corrosion resisting. Register can be applied to types 1-14, 16, 18 and 20 and types D-6, 7, 14 and 15.

FULL DIESEL GENERATING SETS using four-cycle, light-weight engines in capacities of from 6 to 40 kw. a.c. or d.c. have been announced by Fairbanks, Morse & Company, Chicago, for applications where a reliable small capacity supply is required. The units are rated in sizes by the number of cylinders, from one to six.

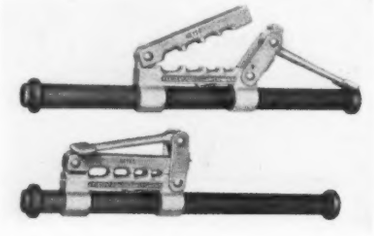
PHOTO-ELECTRIC RELAYS for general industrial use that offer reliability at low cost are announced by the Westinghouse Electric & Manufacturing Company. Heavy-duty contactor in the LE relay interrupts 20 amp. at 115 volts. a.c. non-inductive load or 3 amp., 115 volts d.c. Operating speeds suitable for counting from 200 to 600 objects per minute are possible, depending on amount of light change and contact resistance. Design flexibility permits either on or off operation of the contactor; the standard a.c. unit works with equal sensitivity on any frequency from 25 to 60 cycles. Reliability is obtained through the elimination of telephone relays.

Small-Motor Breakers

Sentinel breakers for the protection of fractional-horsepower motors and designated type H have been announced by the Westinghouse Electric & Manufacturing Company, East Pittsburgh. The breaker is completely inclosed in a molded case, all metal parts are noncorrosive or cadmium plated and the operation handle is the only exposed moving part. These breakers protect against burnouts which might be caused by low voltage, locked rotor or overload conditions in appliance or other small motor applications. A combination bimetal and auxiliary heater self-protecting feature permits heavy starting currents, but time feature will disconnect a motor from the line when locked even when its locked rotor current is relatively low in comparison to its full-load current. Nineteen ratings of thermal elements are available to protect fractional-horsepower motors with full-load ratings between 1.1 and 12.9 amp. and they are interchangeable. Marking of thermal units is indicated by an exposed flush insulating button so cover rating is changed with protecting units without altering the nameplate itself.

Sleeve Wrench Improved

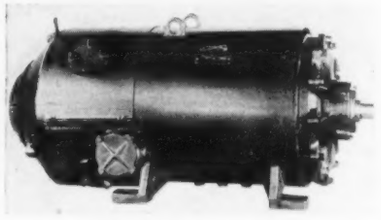
Designed for safety and convenience of the lineman, the No. 750 sleeve wrench of the Crescent Tool Company, Jamestown, N. Y., has been announced with slots to accommodate sleeves for Nos. 0, 2, 4 and 6 solid wire and equivalent



stranded wire sizes. It is said to make possible the production of joints closely approaching 100 per cent theoretical strength. The sliding handle is made of high-grade oil-impregnated hickory to prevent a flash through accidental contact with hot wires. Metal parts are drop forged, heat-treated steel, cadmium plated. Once clamped on the sleeve it need not be removed until the connection is completed.

Inclosed D.C. Motors

Fan-cooled explosion-proof motors for direct current have been introduced by the Louis Allis Company, Milwaukee. Quick and easy inspection of the com-



mutator and brushes is made possible by three quickly removable screw caps providing handholes. The size illustrated is 25 hp. with a speed of 806 r.p.m.

Recording Potentiometers Balanced by Photocells

Photoelectrically balanced potentiometers for recording from one to twelv temperatures in standard or special cha. ranges and identified as "TAG" type 4700 have been introduced by the C. J. Tagliabue Manufacturing Company, Brooklyn. An inertia-less beam of light reflected from a sensitive mirror-galvanometer takes the place of the customary metal boom or pointer and eliminates mechanical connection between galvanometer and balancing mechanism. The galvanometer is free, has a low moment of inertia, and thus is rapidly balanced. The photoelectric cell is not a calibrated element, but only detects the direction of the light beam and brings the galvanometer to zero deflection by the null method of circuit balancing. Shutters intermittently operated in front of the cell detect deflections of the light beam and synchronized electric contacts control the motion of a contact carriage to and fro across the chart and slide wire of the potentiometer. Once balanced, the mechanism records and a multiple switch is turned to a new position.

Recording potentiometers are mounted in an enameled aluminum case 15x12x 12 in., for universal mounting (flush, wall or table); they operate on 110 or 220 volts, 60 cycle supply. Galvanometer resistance is very high and readings are little affected by line-resistance changes; platinum-alloy, non-corroding suspensions are used. Switching contacts in thermoelectric circuit including those of the completely inclosed multiple switch are of platinum-gold alloy.